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NOTES AND COMMENTS.

"Skål to the Norseman! Skål!"

PEOPLE of all nationalities, and especially the friends of science, will greet with a hearty welcome the safe return of Fridtjof Nansen, and the notable results of the voyage of the "Fram." It was on midsummer day, 1893, half-an-hour after noon, that Nansen, with twelve men, left Christiania "on a polar expedition, with the fixed resolve to do their uttermost." It will be remembered that Nansen's plan differed from that of his predecessors in that he took for his allies the forces of nature themselves. The discovery on the east coast of Greenland of flotsam, supposed to be derived from the American ship "Jeannette," which had sunk near the island of New Siberia, about longitude 155° E., and latitude 77° N., suggested that they had been carried across the polar circle by some unknown current. On this idea Nansen's plan was based; the "Fram" was specially built so as to be lifted up by the ice when nipped instead of being crushed by it, and she entered the ice-sea north of the New Siberian islands with the intention of being carried, if not across the north pole itself, at all events nearer to it than man had hitherto penetrated. The scheme was scouted by many old Arctic voyagers, and there were not a few who thought they had seen the last of "the foolhardy Norseman" on that midsummer day three years ago. But the enterprise is justified by the event, and Nansen returns to us, not merely as the most successful of those that had ventured towards the pole, but crowned with the more fruitful honours of important scientific discovery.

The "Fram" left New Siberia, and, entering the ice, was uplifted by it and carried to 84° N. This was already higher than the most northerly latitude previously attained, namely 83° 24', which was reached by Lieutenant Lockwood of the Greely expedition in 1882. Here, however, it appeared that the vessel would not be carried further north, as it was then imprisoned by ice drifting in a westerly direction. Therefore, on March 14, 1895, Nansen and Johansen, who volunteered to accompany him, left the ship, and journeyed northwards with dogs,

sledges, snow-shoes, and two kajaks. They progressed slowly, partly over dangerous ice, partly over open water, till on April 8, 1895, they reached 86° 14′ N., being only 420 kilometres (about 252 miles) from the pole, about longitude 50° E. Icebergs made further advance northwards impossible, so turning towards the east they came, on August 6, to the north coast of Franz Josef Land, which they crossed, and on August 26 again came to open water, in 81° 13′ N. Here they wintered in a hut built of stone, earth, and sealskin, with a bearskin for a door, shooting seals and polar bears, whose flesh they ate and whose fat they burned in a lamp made of sledge bolts. The dogs had to be killed one by one as food for the rest, till at last none were left. On May 19, of this year, the two men set out with the intention of reaching Spitzbergen, and after six weeks' journey, fell in with the Jackson expedition, in whose winter quarters they stayed for a month and a half. At last they returned on board the "Windward," reaching the Vardö at 4.30 p.m., on Thursday, August 13. Nansen reports that all on board the "Fram" were well when he left, and had provisions for 6 years, with 100 tons of coal. He believes that they must by this have reached the east coast of Greenland, and that it will not be long before they are in Bergen.

So far as they can be gathered from the brief telegrams as yet to hand, the chief scientific results of Nansen's expedition are as follows. The existence of a current running across the polar sea from Siberia to Greenland is proved. Petermann Land does not appear to exist; in fact, no great land masses are to be found in this region north of 82° lat. On the other hand, many unnamed islands have been charted. Nansen seems to think that his wintering place was not actually on Franz Josef Land, but that there is an error in von Payer's map. Besides this, there can be little doubt that both by Nansen and by those left on board the "Fram" many observations have been made of scientific importance. So trained an observer as the zoologist of Bergen is not likely to have let slip any opportunities. The cost of this expedition was about £23,000: such vast results have rarely been obtained with so small an expenditure of money, or, as we hope it is safe to add, with so little loss of human life.

[At moment of going to press, we learn that the "Fram" arrived safely at Tromsö, with all well on board.]

THE BIBLIOGRAPHY OF ZOOLOGY.

WE have received from the Committee of the British Association of Zoological Bibliography and Publication the following communication:—

"It is the general opinion of scientific workers, with which the committee cordially agrees:—(1) That each part of a serial publication should have the date of actual publication, as near as may be, printed on the wrapper, and when possible, on the last sheet sent to

press. (2) That authors' separate copies should be issued with the original pagination and plate-numbers clearly indicated on each page and plate, and with a reference to the original place of publication. (3) That authors' separate copies should not be distributed privately before the paper has been published in the regular manner.

"The committee, however, observes that these customs are by no means universal, and constant complaints are made that one or other of them is not put into force. In case the publication or society with which you are connected does not comply with these desiderata, the committee ventures to ask whether it would not be possible for it so to comply in future. Should you, however, have any good reasons against the adoption of these suggestions, the committee would be much obliged if you would kindly inform them of your reasons, in order that they may be guided in their future action.

"The committee further begs to ask for your co-operation in the following matter. There are certain rules of conduct upon which the best workers are agreed, but which it is impossible to enforce, and to which it is difficult to convert the mass of writers. These are: (4) That it is desirable to express the subject of one's paper in its title, while keeping the title as concise as possible. (5) That new species should be properly diagnosed and figured when possible. (6) That new names should not be proposed in irrelevant footnotes, or anonymous paragraphs. (7) That references to previous publications should be made fully and correctly, if possible in accordance with one of the recognised sets of rules for quotation, such as that recently adopted by the French Zoological Society.

"The committee ventures to point out that these and similar matters are wholly within the control of editors (*rédaction*) and publishing committees, and any assistance which you can lend in putting them into effect will be valued, not merely by the committee, but, we feel sure, by zoologists in general."

We have much pleasure in giving further publicity to the request of the committee, but in these matters our own conscience is clear. The printers of Natural Science have always had strict orders to obey the instructions 1, 2, and 3 of the committee, while the editors have always attempted to induce their contributors to follow suggestions 4, 5, 6, and 7. In this attempt they will continue, but they take this opportunity of pointing out to their contributors how greatly editorial labours can be lightened by closer attention to some of these small details.

Pitfalls in Botany.

The great bugbear of the student of botany just at present is the *stele*. It cannot be avoided, for it confronts him at every examination. He gets the latest text-book and grinds it up, or tries to do so, for the result is often hopeless muddle. It looks plain sailing enough. There are the three primordial layers at the growing-point (at least the figures in his text-book show them): *dermatogen*, developing into *epidermis; plerome*, forming the central *stele;* and *periblem*, yielding the *extra-stelar* tissue between the *stele* and the epidermis. The limit of the extra-stelar tissue is the *endodermis*, a layer characterised by the presence of starch in its cells and curious thickenings on its radial

walls. He often fails to find this endodermis when he cuts his sections of the stem; but then sections do not always turn out as they should. He goes on bravely, but *schizostely* puzzles him, and when he comes to *Equisetum* he gives it up as hopeless. We would advise him to put a pin through those pages in his text-book, and go to some library where he can get hold of the April and May numbers of *Science Progress* (it is much too expensive for him to think of buying—an opinion which, unfortunately, is shared by many librarians), and read an account of the history of the theory, with criticisms thereon by Mr. A. G. Tansley. Meanwhile, we will put him up to one or two points. Plausible though it seem, there is really no connection between the dermatogen, periblem and plerome business, and the stelar theory of Van Tieghem. Perhaps, though, relying on his text-book, he does not even know it as Van Tieghem's theory. If he goes into the question, he will find that recent observers are not by any means certain about these three initial layers at the growing point, and that the stelar theory must, in the present state of our knowledge, be considered quite apart from them. Briefly, it is something like this. There is a striking similarity in the internal structure of all roots, as Van Tieghem showed nearly five-and-twenty years ago. They contain a central cylinder, in which, before matters become complicated by secondary thickening, we find strands of wood and bast separated by parenchymatous "conjunctive cells," the whole surrounded by a *pericambium*, or *pericycle*, and bounded on the outside by the innermost layer of the cortex, which shows the characters that we associate with an endodermis. The great service of Van Tieghem to the study of plant anatomy was in showing that this arrangement in the root is continued through the hypocotyl into the stem, and that in stems of many seed-plants it is possible and easy to trace a pericycle continuous with that of the root and surrounding the system of vascular bundles separated by conjunctive tissue, with which is included the pith. Continuous also with the endodermis of the root is a similar layer, with similar characteristics, forming the limit of the cortex towards the central cylinder or stele. The root, hypocotyl and stem have one continuous stele—are, in fact, *monostelic*. There are cases, however, where the very best of sections reveal no endodermal layer round the central bundle-system. Now, an endodermis cannot be imagined. As Strasburger has pointed out, it is a layer whose cells have certain histological characters to which we have referred, these characters being associated with certain physiological properties. It is, in fact, a layer that will transmit water, but not air; as such it is eminently of service in enclosing the water-conducting system, and therefore very frequently found surrounding it; but it may, and does, occur elsewhere, and must not be considered as an integral part of the stelar theory. To avoid this Strasburger suggests a new term, *phlœoterma*, for the layer next outside the stele and surrounding it. The phlœoterma may have endodermoid characters, or it maybe

indistinguishable from the other cortical layers. On this assumption the great stumbling-block, *Equisetum*, is easily removed. Formerly we were bothered by the vagaries of the endodermis, which sometimes surrounded each bundle, sometimes formed a double ring bounding the bundle-system towards both the cortex and the pith, or sometimes behaved properly and ran round the outside only. Now, if we imagine instead a phlœoterma, which in every case surrounds the whole bundle-system, having, in the two last-mentioned cases, the characters of an endodermis, and, in the first, no character at all by which we can distinguish it, we bring *Equisetum* into a place in the theory as a monostelic plant.

In stems of ferns and selaginellas, in the roots of a few palms, and in the stems of *Gunnera* and species of *Auricula*, among dicotyledons, something different occurs. The single stele of the root, in passing through the hypocotyl, breaks up into several steles. In such cases the stem or root is *polystelic*, each stele containing bundles of wood and bast, separated by conjunctive tissue, surrounded by a pericycle, and bounded at the cortex by the phlœoterma, which generally shows endodermoid characters. As the student who has cut sections of the bracken-fern will remember, the steles are not always cylindrical, but may be oval or drawn out into a band; in fact, they may show considerable variation in shape.

Finally, the term *schizostele*, or *meristele*, is applied to those portions of the stele, or steles, of the stem which run up into the petiole and, as in *Pinus*, continue unbroken through the leaf, or, as is generally the case, branch repeatedly in the flat, expanded blade. The advantage of the stelar theory is that it supplies what we have hitherto wanted, a general standpoint from which to view the internal anatomy of the plant axis and its branches. It directs attention to the vascular system as a whole, and not, as hitherto, to the vascular bundle, which, implying very different things in different cases, does not admit of a comparative treatment.

Plant Evolution.

There are often several ways of looking at the same thing. A flower, for instance. We were wont to define it as a shoot modified for purposes of reproduction. Goethe's Ur-plant showed how the petals, sepals, stamens, and carpels were after all only leaves which, in virtue of their respective functions in connection with the ultimate object of forming fruit containing seeds, assumed shapes differing more or less widely from what we generally associated with the term leaf. That is to say, the popular leaf being the flat expanded green foliage-leaf, we felt constrained to derive the floral leaves from such a one. We could fold one up nicely to make a carpel, but stamens floored us rather, and we rejoiced over the water-lily, which showed us how it had all happened, supplying a complete transition from the flat

'leaf'-like petal to the anther-bearing filament. Double-flowers and monstrosities delighted us, for in them we saw a harking back to the original form. If we imagined anything of evolution it was an ordinary foliage shoot, becoming in course of ages converted into a flower, perfect and complete. And after all we found nothing in our text-books, and heard nothing at our lectures, to contradict our little theory.

The outer series, the sepals and the petals, were concerned mainly with the protection of the 'essential' stamens and carpels, or with visits of insects and other creatures associated with the deposition of pollen on the stigma. The pollen-sacs of the stamen, and the ovules borne by the carpel, were sporangia comparable with those borne on the fertile leaf of a fern, or the sporophylls of an *Equisetum*. But when we came to study 'types,' beginning with the unicellular plant, and working upwards, doubts would sometimes arise. Our series of types we somehow thought represented stages in evolution. The complex seed-plant had gradually evolved from the simple monad. But the latter was in the habit, at certain periods of its life-history, generally when times were hard, of simply becoming a sporangium, its living cell-content contracting to form spores. Obviously, the sporangium existed long before the leaf. Were we right then in deriving, as our training certainly tended to make us derive, the sporophyll (stamen, or carpel, or what not) from the leaf? What was faintly foreshadowed in these doubts may become a reality for the next generation of students. There are some who tell us that the sterile tissue which we find forming bands between the spore-producing cells in the sporangium of *Isoetes*, or segmenting the pollen-sacs of certain seed-plants, recalls the commencement of the evolution of vegetative from reproductive tissue; and that in such sterile tissue, in fact, we see the origin of the vegetative structure—root, stem, and leaf—of the higher plants. We shall then have at any rate a consistent plan of evolution, though one not easily admitting of proof.

HYDROCYANIC ACID IN PLANTS.

IN the *Annales du Jardin Botanique de Buitenzorg* (vol. xiii., pt. i., 1895) appears a most interesting and important paper by Dr. Treub, entitled "Sur la localisation, le transport et le rôle de l'acide cyanhydrique dans le *Pangium edule*, Reinw."

This paper seems to throw some light on the steps in the formation of proteid by combination of the substances formed by assimilation in the leaves with substances absorbed by the roots. In *Pangium edule* large quantities of hydrocyanic acid (HCN) occur, either free or in an unstable combination. The substance obviously is of great importance in the metabolism of the plant, and its occurrence and behaviour have been studied in detail by Dr. Treub.

In the stem and roots it occurs chiefly in the phloem, while in the leaf it occurs in most of the parenchyma cells, but also in certain specialised cells of the epidermis. To these last Dr. Treub assigns the formation of the acid. By various experiments he showed conclusively that it is transported through the phloem. For its appearance in the leaves he found certain conditions necessary. He could not prove that the presence of carbo-hydrates was required, but in the absence of light and carbon dioxide the acid rapidly disappeared from the leaf. It would appear, then, that the carbon and hydrogen of hydrocyanic acid comes from assimilated carbo-hydrate, while the nitrogen must be obtained from material absorbed by the roots.

In accordance with this supposition, Dr. Treub found that interference with the supply of water tended to prevent the appearance of hydrocyanic acid in the leaf; thus, if the vascular bundles of certain lobes only of a leaf be cut, these lobes continue to grow, but much less of the acid appears in them than in the uninjured lobes. The connection between water-supply and the presence of hydrocyanic acid is also borne out by another very interesting observation; it was found that the lowest leaf on the plant was entirely or almost entirely free from hydrocyanic acid; but, on removal of all the upper leaves of the plant, hydrocyanic acid soon appeared in the lowest leaf, the reason being, as Dr. Treub believes, that this leaf has now the whole water-supply to draw upon, and so is no longer starved for want of nitrogen salts.

From a study of the conditions for the appearance of hydrocyanic acid in the leaves, Dr. Treub concludes that in *Pangium edule*, at least, "hydrocyanic acid is the first recognisable product of nitrogen assimilation." He believes that the carbo-hydrate formed in ordinary assimilation is combined with nitric acid (set free by the vegetable acids from the nitrates absorbed by the soil) to form hydrocyanic acid, and that this, by further anabolic change is converted into proteid.

These new and suggestive observations will no doubt lead to further work from which certain conclusions may come. As yet Dr. Treub cannot be said to have given direct evidence that carbo-hydrates and nitrogen salts are necessary for the formation of hydrocyanic acid; nor for his important inference that the acid is the first recognisable product of the assimilation of nitrogen. Hydrocyanic acid might equally, so far as we know, be a product of the decomposition of some more complex organic body.

Botanical Drawings.

An interesting series of coloured drawings of plants is on view at South Kensington, in the Botanical Department of the British Museum. The largest amount of space is justly devoted to the beautiful and yet botanically accurate sketches of the brothers Bauer.

The elder, Francis, was born at Feldsberg, in Austria, in 1758. In 1788 he came to England, and was induced by Sir Joseph Banks to remain as draughtsman to the Royal Gardens at Kew, Sir Joseph himself defraying the salary during his own life, and providing in his will for its continuance. Bauer spent the rest of his days at Kew, and died there in 1841, in the eighty-third year of his age. His numerous drawings of the plants of the Gardens are now preserved in the British Museum. A selection was published in 1796, under the title "Delineations of Exotick Plants cultivated in the Royal Gardens at Kew," but three parts only, consisting entirely of heaths, were published. He also prepared an elaborate series illustrating the structure of the grain, the germination and growth of the wheat-plant; these are well described by his biographer in the *Proceedings* of the Linnean Society (i. [1841] p. 102) as "perhaps the most splendid and important monument of Mr. Bauer's extraordinary talents as an artist and skill in microscopic investigation." Within the last few years Mr. Carruthers has, under the auspices of the Royal Agricultural Society, reproduced a selection of these in sheet form, illustrating the life-history of the wheat-plant from seed to seed. Another beautiful and detailed series of drawings of orchids supplied material for Lindley's "Illustrations of Orchidaceous Plants."

Ferdinand Bauer was born at Feldsberg two years after his brother. It is of interest to note that the father held the appointment of painter to Prince Lichtenstein. When only fifteen years old Ferdinand was employed in making miniature drawings of plants from nature. In 1784 he accompanied Dr. Sibthorp to Greece, and the completion of the numerous drawings made on the journey occupied several years after his return; he was, in fact, thus engaged in England at the time of his brother's arrival. In 1801 we find him selected by Sir Joseph Banks to go with Captain Flinders as natural history painter to Australia, Robert Brown being the naturalist. When Captain Flinders went back to Europe, Brown and Bauer remained behind in New South Wales. Before returning home, in 1805, Bauer also spent eight months in Norfolk Island, collecting and making drawings of the plants, and from these materials Endlicher compiled the "Prodromus Floræ Norfolkicæ." In 1813 he began his "Illustrationes Floræ Novæ Hollandiæ," a magnificent undertaking, which, however, met with so little encouragement that only three parts were published, the artist in the meantime retiring in disgust to Hitzing, near Vienna, and the large botanic gardens of Schönbrunn. Except for a visit to England in 1819, and occasional botanical excursions into the Austrian and Styrian Alps, the remainder of his life was spent near the Austrian capital, his chief occupation being the drawing of the more remarkable plants which flowered in the Imperial Gardens. He died in March, 1826. His paintings of Australian plants passed into Robert Brown's hands, and subsequently became the property of the British Museum.

The only artist, who, for the beauty and accuracy of his work can be compared with the Bauers, was George Dionysius Ehret, several of whose drawings are shown. Ehret was born in Saxony, in 1708, but, like Francis Bauer, found a home in England, where he worked at his art, and died in 1770. We have already referred to his life and career in a recent number of NATURAL SCIENCE (vol. viii., p. 367).

Of the other last century artists whose work is represented, Sydenham Teak Edwards was born at Abergavenny (1769 ?), and died at Chelsea in 1819. He was a protégé of William Curtis, the founder of the *Botanical Magazine*, and for many years during the life and after the death of his patron drew the plates for that journal. He also drew for the *Botanical Register* for several years, from its start in 1815. James Sowerby (1757–1822), who was born and died in London, is known chiefly for his connection with the "English Botany," all the original drawings and proofs of plates for which are in the Botanical Department. One of the most conspicuous objects in the Public Gallery of this section of the museum is his collection of models of British fungi. Of John Frederick Miller (fl. 1776–1794), Frederick Polydore Nodder (fl. 1777–1794), and Sydney Parkinson (died 1771), we know but little. From Britten and Boulger (British and Irish botanists) we learn that Nodder was botanic painter to Queen Caroline, and also drew and engraved the plates for Martyn's "Flora Rustica," while Parkinson was another protégé of Sir Joseph Banks, with whom he went to the South Seas in the "Endeavour," in 1768, as draughtsman; he died on the Indian Ocean in January, 1771. The sketch of a white lily on a black ground, by John Christoph Dietzsch (1710–1769), represents an old and striking style of plant-portraiture.

Of nineteenth century artists, specimens of whose work is shown, Walter Hood Fitch was born in Glasgow in 1817, and died at Kew in 1892. His most important botanical work was in connection with the *Botanical Magazine* and Hooker's "*Icones Plantarum*," both of which he illustrated for more than forty years. Of Mrs. Withers, to whom is due the beautiful sketch of a columbine, we know nothing, and the same applies to the Chinese artist who produced the two elegant drawings of chrysanthemums. Worthington Smith is still with us, and much in evidence in the Botanical Gallery, of which his illustrations of British Basidiomycetes form a conspicuous ornament, besides affording valuable help to students of a group of plants which it is impossible to keep in anything approaching to a natural condition.

In our remarks we have had to refer again and again to Sir Joseph Banks, to whom botany, and especially the Botanical Department of the British Museum, owe an unmeasurable debt of gratitude. It is appropriate to find him, represented by the beautiful statue by Chantrey, as sitting between the two cases in which the drawings are shown, his head inclined towards the one containing the work of the two Bauers.

ANTHROPOLOGY.

It is well known that the Negrillos of Central Africa, *i.e.* from the country of the Mombuttus to the West Coast, resemble in many ways the brachycephalic Negritos of South-Eastern Asia. Side by side with these rounder headed pigmies are dolichocephals; one of these, a Babinga (Aka) woman from the Sangha River, is the subject of a paper by Dr. R. Verneau, in *l'Anthropologie* (vii., p. 153). The estimated cranial capacity (1,440 *c.c.*) is by no means small, it being above the average European female. The skull is very dolichocephalic (73·2), very platyrhine (63·5), mesoseme (87·8), and has a considerable sub-nasal prognathism. The pelvis exhibits characters intermediate between those of a true negress and a European. The mesaticephaly which is met with to the west of the pigmy territory, may be due to a crossing between brachycephalous Negrillos and Negros of tall stature; these are the semi-dwarfs ("demi-nains") of Mr. Hamy. If a comparison be made between the measurements given by Dr. Verneau and those published on various pigmy peoples, it will be evident that the former could scarcely belong to a person of pigmy stature, that is, with an average male stature below 4 ft. 9 in., and we must, for the present, be sceptical as to this individual being a true dolichocephalic pigmy.

The subject of infantilism, femininism, and the hermaphrodites of antiquity, has been carefully studied by Mr. Henry Meige in *l'Anthropologie* for 1895. He came to the conclusion that "there exist in nature several bodily conformations in which the morphological characters of the male are associated in the same individual with those of the female. These hybrid forms should be considered as anomalies of development resulting from a congenital alteration of the trophic centres which regulate the evolution of the sexual organs. They can be referred to infantilism, femininism, and virilism." Mr. Meige finds that the representations of hermaphrodites in the ancient world fall into two classes:—1. Those which are simply artistic creations, in which the female form—more rarely the male—is provided with organs that belong to the other sex. 2. Those which represent a natural type, these being forms exhibiting infantilism, or, most frequently, femininism. These the author believes were copied from the life. In the current number of the same journal Dr. O. Ammon has a communication on the same subject, in which he points out that though permanent infantilism may occur, in most instances this is only a transient stage; that is to say, virile development may be exceptionally retarded.

The causes of this sexual retardation may be racial or due to unfavourable economic conditions. Usually these cases of retarded virility occur among very poor families, but he has sometimes seen boys of the middle classes, in comfortable circumstances, not attaining a virile character till the age of seventeen, whilst the mean age of puberty of this class is from thirteen to fourteen years of age. It is clearly necessary that the subsequent history of the patient should be

followed to see whether the retardation is temporary or permanent. Similarly he finds femininism may be transient or lasting. Dr. Ammon had previously stated that the Greeks imitated nature, and thus the origin of the classic hermaphrodite can be explained in a simple manner, and without obscenity on the part of the artists. Infantile individuals, from nineteen to twenty-two years of age, should not be regarded as anomalies; most are retarded cases who will develop in course of time. This temporary kind of infantilism is chiefly found in individuals of short stature and smooth body. Permanent infantilism is rare, but occurs among men of all heights. Femininism, as manifested by the development of the breasts, is not rare among boys, but usually it is only temporary, and eventually disappears completely. When the growth does not soon stop, it develops to a pronounced extent, and breasts comparable to those of young girls of fifteen are developed; in this case it remains permanent, but does not influence the other organs, which develop normally.

North American Mammals.

One of the most interesting and important of a number of recently published papers on the North American mammals is from the pen of Dr. Hart Merriam, and deals with the bears (*Proc. Biol. Soc., Washington*, vol. x., p. 65). The author states that after an examination of a very large series of skulls, he is convinced that the generally accepted classification is quite inadequate. Four new species are described, three of which are bears of huge size, inhabiting various parts of Alaska and the adjacent islands, while the fourth is the black bear of Florida. In the classification proposed, five distinct types are distinguished; of these subdivisions the first includes only the polar bear, which is regarded as a distinct genus, *Thalaretos*, the second comprises the black bears, forming a subgenus *Euarctos*, while the remaining three, including the grizzlies and three of the new species, are placed under *Ursus*. The new forms are described in some detail, and the paper is illustrated by a number of rather unsatisfactory reproductions of photographs of skulls. A complete treatise, of which this paper is only a preliminary summary, is promised.

Another paper by the same writer, published by the United States Department of Agriculture, consists of a synopsis of the North American weasels. No less than twenty-two species, of which half are new, are recognised; whether such a multiplication of specific names is necessary or desirable seems somewhat questionable. Two chief types are distinguished, the first including the boreal species, which do not range south of the northern states, the second, the southern forms, only one of which extends up to the lowest boreal zone. Between these main divisions occur two intermediate forms, which are particularly interesting from the fact that in both of them

the females resemble one of the boreal species (*Putorius cicognani*), while the males are similar to two of the austral forms. According to Dr. Merriam, the explanation of this phenomenon is that the female in mammals is often less specialised than the male, and therefore approaches the ancestral type more nearly: the inference in the present case being that the intermediate form is derived from the *P. cicognani* type. On similar grounds it is shown that the arctic weasel is probably a descendant from the same form. It may be remarked that in certain closely-allied species of birds the same peculiarity occurs.

Of two papers by G. S. Miller, junr., on American bats, one describes the milk-dentition in *Desmodus*, a genus of blood-sucking bats; the other contains an account of a species of *Thyroptera*, an interesting peculiarity of which is the occurrence in the hind foot of a kind of syndactylism, the third and fourth digits being so closely united that their claws appear to form one large nail.

The West Prussian Museum at Dantzig.

In the *Report* for 1895 of the Dantzig Museum, Dr. Conwentz gives an interesting account of a "prehistoric" boat dug out of a field in Baumgarth, near the River Drausen, in West Prussia. It was a saying among the people that a boat lay buried under this field, and that in old times pieces of the wood had been dug up. Public interest in the matter was aroused by the landowner, Mr. E. von Riesen, who in the summer of 1894 set to work and found in a ditch a blackened piece of oak, pierced by an iron nail. Thereupon the Museum authorities decided to investigate thoroughly, though, owing to unfavourable weather, their task was only begun in June, 1895. At the place where the boat was found the ground consists of a layer of peat one metre deep, under which lies river-sand. The boat was found in a natural position, with the keel downwards; its planks were loosened, and several pieces were missing. All the pieces found were sent to the museum, where they were carefully cleaned and soaked in a mixture of petroleum and varnish, to prevent contraction and drying-up of the wood. The whole boat has been reconstructed, and a figure of it is given, from which we see that the art of boat-building must have been already well advanced in those days.

The age of this boat is somewhat doubtful, but Dr. Conwentz brings forward some carefully worked out arguments, which he sums up as follows:—"When one considers that this boat, in its shape and build, resembles the vessels of the Vikings; that at the Viking time, about the middle of the ninth century, a traveller came over the sea from Schleswig to this neighbourhood, a journey whose details, as recorded in history, exactly fit my conclusion; that in this part countless coins and weapons are known from the Viking time; and finally that this boat was found buried away from the Sorgefluss and the

Drausensee—one is led to the conclusion that it is a Viking boat. It came from the north through one of the then existing channels into the Frische Haff, and on through the Elbing into the Drausen. Obviously it had a bad journey, since one plank has been repaired; and finally it became a complete wreck by running on a sandbank near the mouth of the Sorge. Since, however, the water was shallow and the shore close, the occupants saved their goods. Through the continuous movement of the waves the woodwork became loosened, and some pieces drifted away with the tide. By the gradual drying up of the water, the wreck became covered over by slime and marshy earth, and in this way the wood and the few iron parts have been preserved by complete isolation from the air."

Dr. Conwentz aims, he says, at making his Museum representative not only of the purely scientific relationships of western Prussia, but also (within limits) of the province of applied sciences. To this end the collection of fishing appliances belonging to the Fisheries union, as well as its library and collections of maps, and the valuable collection of appliances from the Apicultural Society, have been put in charge of the Museum, and stored in a room till extension of the main building will permit their being removed. The attendance, especially on Sundays, is very satisfactory, although the number of schools visiting the Museum might be larger.

The geological mapping of this province is proceeding slowly; but, through the generosity of the State and the Council of Landowners, who recognise the importance of this work, two more geologists will probably be added to the staff.

"Light! Light! more Light!"

The health-giving power of sunlight has long been believed in, but the belief has been acted on in an half-hearted way. With one hand we enlarge our windows, with the other we draw curtains across them; we send our children to the sea-side for a summer holiday, encouraging them to bathe and paddle, while for the rest of the year we make them wear boots and shoes and all the other necessary evils of civilisation, and coddle them up indoors as much as possible. A special retreat even has been provided among the mountains of Illyria, far from the eye of the police, where, as in a paradise regained, the sedentary sufferers of city life may wear no other covering than that which nature has provided, and may bathe themselves in pure sunshine. The belief then exists, but only recently has it been set upon a scientific basis. In his address as president of the chemistry and engineering section at the recent meeting in Glasgow of the British Institute of Public Health, Professor Wm. Ramsay explained how the violet rays of sunlight act upon moist organic matter, producing hydrogen peroxide; how this peroxide bocomes water and hands on the remaining portion of oxygen to the organic matter, which it thus

destroys or changes. Now, these changes are destructive to the life of minute organisms, such as the bacteria in sewage, and the germs of many, perhaps all, zymotic diseases, such as typhus and anthrax. These are the conclusions to be gathered from the recent work of Professor Marshall Ward, Dr. Arthur Richardson, and Dr. E. Frankland.

We must have sunlight. In our rapidly-growing cities its admission is a necessity for the commonweal, its exclusion a crime. But hitherto the conditions of city life, in England at least, have tended more and more towards the exclusion of sunlight. The smoke that goes up, not only from our factories but from every private house, that stretches over London like a veil even on the clearest summer Sunday, this not merely acts directly as a screen against the sun, but condenses around its particles the vapour of the atmosphere, forming mists, pea-soup fogs, and rain-clouds, all which shut off from us just those violet rays that we need for the destruction of the rapidly-increasing bacteria. Professor Ramsay, speaking in the smoke-vomiting city of the north, urged the same remedies as have been urged by all who have thought on this subject; first, more stringent enforcement of the Smoky Chimneys Act, and of municipal bye-laws against smoke; secondly, the adoption of smokeless fuel, such as coke or coal-gas.

Professor Ramsay's valuable and thoroughly interesting address should be studied by all town and county councillors, and we should like to see it reprinted and placed in the hands of all householders and especially housewives. The gas companies might undertake its distribution along with the quarter's notice.

The Disposal of Sewage.

Professor G. V. Poore, at a lecture delivered at the Royal Institution on April 24, 1896, discussed the disposal of organic waste matter. He began by explaining in detail the general course of the circulation of organic matter, and the part played by fungi and bacteria in the cycles of change. Quoting from Mr. Megnin, the French entomologist, he gave an account of the successive sets of insects that appear in gradually decomposing animal matter; while on the authority of Mr. George Murray, he described the varieties of moulds that assist the decomposition of the dung of different kinds of animals. These interesting facts were the prolegomena to his first proposition, the proposition that the superficial layer of humus, full of bacteria, is the great cleansing filter of the world. Organic matter that is mixed in due proportion with this humus, if it be not flooded by water, is rapidly decomposed into a condition which makes it the best possible manure for crops. Just as a valuable soil is gradually formed on barren rocks by the growth and decay of various forms of animal and plant life, so, according to Professor Poore, a due use of the

waste of animal life would continually add to the fertility of all soils, the gain being ultimately at the expense of the sea and the air.

He placed our actual modern use of sewage in strong contrast to what ought to be done with it. In the first place, he regards the modern system of water drains as in the wrong direction. The sewage is led below the humus "to the wrong side of the natural cleansing filter," and there it gradually poisons the wells and underground water-supply, while it is wasted from the agricultural point of view. He regards the elaborate drainage systems of modern suburban districts as a positive danger, and as a great waste of money.

We are prepared to agree with him that in thinly populated areas, the expense of elaborate water-supply and of elaborate main drainage systems is by no means necessarily a financial success, or a gain from the point of view of public health. But it is more difficult to agree that the possibility of water-drainage systems has produced the modern huge blocks and crowding of population. The ordinary conditions of modern life make it almost a necessity that people should live as near as may be to the centre of populous areas, and modern drainage is a mitigation rather than a cause of this concentration. The shortening of hours of labour, the establishment of means of communication between the centre and the suburbs at a cost which shall not be too large a tax by land owners upon wages, are the chief means which may be looked to for decreasing condensation of population, and for making possible a direct return to the soil of organic waste. On the other hand we cannot agree that the organic matter swept down the rivers to the sea is by any means a complete waste of capital. It is a well-known fact that the fisheries round the coasts are more valuable than the agricultural produce of our soil. The closest connection exists between sewage and fish. Where foul rivers actually roll into the sea animal life is not abundant, but as soon as the water laden with organic matter is diluted sufficiently by sea-water, a new circulation of organic matter begins. The prolific fisheries of the Dogger-bank, and of the region out from Grimsby are related to the sewage of the Thames. The rich fisheries of the Cornish coast return to England the organic waste discharged from the Bristol Channel, while the fisheries of the west coast and its lochs owe their origin to the Clyde, that "foulest sewer of Europe."

The Courtship of Grasshoppers.

The shrill note of the grasshopper is a familiar sound to the holiday-maker in the Alpine pastures. Professor E. B. Poulton has recently (*Trans. Ent. Soc. Lond.* 1896, pp. 233–252) given a most interesting account of his observations of the habits of these creatures in Switzerland, with the object of elucidating the relation between stridulation and courtship. He narrates his observations in detail and

draws the conclusion that stridulation is only exercised by the males "with direct reference to females, or in rivalry to other males in the presence of a female"; only in one species, *Stethophyma fusca*, did the males stridulate in the absence of the other sex. When the male has secured a partner he, as a rule, ceases to make a noise. However, in the small species *Pezotettix pedestris* in which both sexes have vestigial wings, and the male is accordingly unable to produce sound, he obtains a female by "capture," jumping upon her back. While in that position he moves his hind legs alternately, recalling, in Professor Poulton's opinion, the lost power of stridulation.

A Registry Office for Snails.

The meaningless record of variations, mis-called "varieties," seems to afford a kind of conchological small-beer to many collectors of shells. The bands on certain British shells are a source of never failing delight to some; whilst all have one time or another had a turn at them. All appear equally ignorant of the fact that it has been fully done before by Sauveur (*Ann. Soc. Mal. Belgique* ii.), who first drew up the scheme of the eighty-nine possible variations in the five bands of *Helix hortensis* and *H. nemoralis*. The latest venture in the undertaking is a 'Label List' by the editor of *Science Gossip*, Mr. J. T. Carrington, published at the cost of one penny, that should rejoice the heart of the zono-maniac. A page of introduction is followed by a list of the named "varieties" (save the mark!) of *Helix pomatia*, *H. aspersa*, *H. nemoralis*, and *H. hortensis*. The last four pages, printed on one side only, are devoted to a repetition of the names of the last two species, accompanied in each case by one of the band formulæ.

The worst of it is, that like the farmer with the claret, "no one seems to get any forrarder," and no systematic use seems to have been made of these tables. The only published account we know is that by Mr. A. Belt (*Report Ealing Micro. and Nat. Hist. Soc.*, 1892), who proved the existence of twenty-seven out of the eighty-nine possible variations. We have also seen an unpublished record of thirty-three for the two species.

Nobody, unfortunately, has yet gone to the animal and endeavoured to show the origin and cause of these bands on the shell, and whether they have or have not any physiological bearing. The subject is being left to the variety-mongers, whose ultimate goal must inevitably be a registry office for snails.

I.

On English Amber and Amber generally.

II.

HAVING discussed the properties of succinite, and obtained a knowledge of its geological occurrence and distribution, it would be of interest to inquire into the plants from which it was produced somewhere near the beginning of the Tertiary period. It has already been mentioned that succinite is to be found together with rounded carbonised pieces of wood, but of course, these disconnected pieces need not have produced it. Only such specimens as are enclosed by the fossil resin belong with certainty to the succiniferous trees. Concerning the method of examining these woods, one was formerly content to get some splinters of them by cutting with a knife, and this was the way in which H. R. Goeppert, who made some very creditable investigations of succinite, proceeded. But these preparations are not sufficient for investigating the finer microscopical structure, wherefore I have made use of the method of examining petrified woods by microscope-sections that was invented sixty-five years ago in England: for William Nicol first prepared microscope-slides and H. T. Witham published the method in his "Observations on Fossil Vegetables," London, 1831. Thus I have obtained such correct and large sections of the wood that they could be figured in my monograph of the Baltic amber trees.[1]

In general, the preservation of the wood and bark is good, sometimes very good, because nature itself has encased the pieces in the liquid resin, just as we put up sections of recent plants in Canada balsam. Therefore, all the details of the structure are often as well seen as in living plants. The wood is formed of tracheids, which are arranged in distinct rings of growth, representing probably annual rings. The walls of the tracheids, especially the radial walls, are furnished with one to three vertical rows of bordered pits. Moreover, there are vertical resin ducts, surrounded by parenchymatous cells and horizontal medullary rays, which also often enclose a resin duct; the middle of the wood is filled by the medullary cylinder or pith.

[1] "Monographie der Baltischen Bernsteinbäume, &c." Mit 18 lithogr. Tafeln in Farbendruck. Danzig, 1890.

Regarding the origin of the resin, it must be noted that it was produced from the various organs of the trees, *i.e.*, from their roots, stems, and branches, and was also formed in different parts of these organs, not only in the wood cylinder, but also in the bark and pith. No doubt the chief production took place in the wood. The normal formation occurred in these just-mentioned channels or ducts, which cross the wood cylinder in a vertical and horizontal direction. Occasionally resin was formed in an abnormal manner, by foreign influences. So, for example, the common resin ducts could become enlarged and multiplied; moreover, new ones could arise by dissolution of abnormal parenchymatous cells, or of the normal tracheids in any part of the wood. The nature of the cause of these abnormal processes is so far unknown, but probably they were due to external influences.

All these masses of resin were formed in the interior of the stems and branches, and would also have remained there if there had been no injury to the bark and wood by which the resin-ducts could become exposed. Certainly those injuries occurred very often in various ways, for at no time has any natural forest existed which contained a single entirely sound and uninjured tree. This natural state of things is now-a-days not so well seen in the well-kept parks of England as in mountain forests of the Continent or of the north, where little or no artificial interference is made by man. If we pay a visit to the virgin forests of the present time, we are able to study at the same time the state of forests of past geological ages, before man appeared. First of all, every tree in life is damaged by the formation of the bark, and this process can be increased by the influence of the atmosphere and heat, by the action of fungi, insects, and other organisms. But much larger quantities of resin will flow out, if the wood itself is injured. This happens naturally to every stem when throwing off its older branches, and, therefore, the knot-holes are to be considered the proper points of outlet of resin. However, there are still more agents at work by which the wounds might be multiplied; as by the falling down of neighbouring trees during storms or when weakened by old age; then lightning and other atmospheric influences may deprive a tree of its branches. Sometimes small splinters of wood are enclosed by succinite, and, besides that, a few pieces of succinite present an exterior looking just as if they had caught fire in the forests of those ages.

The resin within the trees was very liquid, of a light yellow colour, and transparent, but in flowing out it mingled with cell-sap of the damaged tissue, and it acquired a dull appearance and a denser quality. In such a manner drops or irregular larger masses of resin were forced out of the knot-holes and other injured parts of the trees (Fig. 1, A). But, afterwards, through the influence of the sun, the enclosed liquids evaporated, and the thick clouded masses of resin became again thinner and clarified. Of English succinite I know some pieces which

illustrate this process of clarifying very well. There are, for instance, in the possession of Mrs. A. Fox and Mr. W. George Sandford at Cromer, specimens, one half of each of which is dull and opaque, while the other is quite clear. In the liquid state the resin ran over the bark and formed successively thin lamellæ, called *Schlauben* in German. At this time little animals might pass over it, and small leaves, flowers, or other things might be blown against it by the wind; these becoming attached would be enclosed by the next flow. The chief animal remains consist of insects, particularly of Diptera and Coleoptera; however, there are also a good many arachnids, a few crustaceans, annelids, and shells of snails. Moreover, small

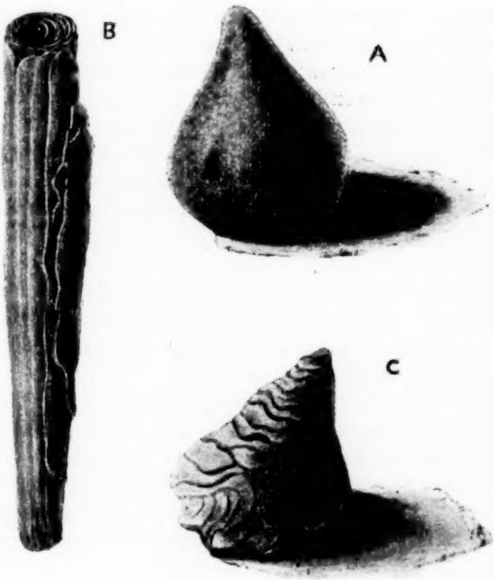


FIG. 1.—EXAMPLES OF AMBER.

A, Amber drop; B, Amber stalactite; C, Amber stalagmite. (Original.)

feathers of birds and hairs of various mammals have been found in amber. Thus, in general, remains of many plants and animals of that period are enclosed in the resin of the succiniferous trees, and are preserved to these days in their transparent grave. Therefore, this kind of succinite is of the greatest importance in the examination of the flora and fauna of the oldest Tertiary, and such pieces are much sought after in the trade. In England I know many *Schlauben* without enclosures, and Mr. Reid has given me a small specimen from Cromer; but such pieces of English succinite containing the remains of plants and insects are also well known. Mr. Alfred S. Foord

N 2

has published in the *Transactions* of the Norfolk and Norwich Naturalists' Society (vol. v., part i., pp. 92–95) a paper on such a collection, belonging to Mrs. Burwood, of Yarmouth, and he has figured therein an undetermined leaf as well as bees, beetles, flies, gnats, and spiders. Twelve years ago Mr. C. Reid mentioned some Diptera and spiders, determined by Mr. G. H. Verral, in his aforesaid paper (*op. cit.*, vol. iii., pp. 601–3). Although I have not been able to see these little collections, I believe that they consist of real succinite, and not of another kind of resin. I saw in the shop of Mrs. A. Fox, at Cromer, three pieces of succinite with dipterous insects belonging to the genera *Platyura* and *Xiphandrium* (?), according to the determination of Mr. Verral (*op. cit.*, vol. iv., pp. 247–8).

Further, it might happen that the resin in clarifying did not form lamellæ upon the bark of the trees, but flowed freely down and formed stalactites, hanging perpendicularly from the branches and twigs (Fig. 1, B). In continuation new flows could run over it, wherefore larger pieces show always a concentric structure. Just as in the case of the *Schlauben*, of course these objects may often enclose small organic remains, especially gnats and other little insects. If the resin dropped down from the stalactites to a lower branch or to the earth, small stalagmites could arise here, corresponding to those, and gradually increase in size (Fig. 1, C).

In general, much resin ran downward and mingled with dead organic remains which covered the ground of the amber forest; for instance, small particles of the destroyed woods of fallen trees, various wing-cases, and dung-pellets of insects. In such a manner there were formed upon the ground irregular pieces of succinite, which certainly are of scientific interest, but do not possess any notable value in commerce, for these pieces are only used for preparing varnish, and are, therefore, called shortly "Varnish" (*Firniss*). Also in England "Varnish" occurs, and I remember seeing two yellow pieces of it with particles of wood from Felixstowe, in the possession of Mr. Henry Miller, of Ipswich.

It is true the greatest quantities of succinite would be outside the trees, but an instance exists of pieces of succinite being formed in the interior of the wood. It was stated before that sometimes a tissue of parenchymatous cells abnormally appeared between the egular tissue of tracheids, and was dissolved afterwards into resin. If it happened that these closed reservoirs did not become opened by a fracture of the wood, the resin would become hardened and remain in the interior for ever. Long after death, when the wood was destroyed by the action of fungi and insects, those large pieces of succinite would become liberated. As they were formed in the interior, mixed with cell-sap, they look muddy and opaque, and they do not enclose any remains of insects or other organisms. They are called Plates (*Platten*), on account of the tabular shape, and yield a very valuable article for working.

After these remarks, the question to be discussed is to which genus the succiniferous trees belong. No doubt they are conifers, and I consider that all details of anatomy agree entirely with the genus *Pinus*, L., though it is undecided if they belong to the genus *Pinus* in the restricted sense, or to *Picea*, Lk. Since the succinite contains, moreover, the flowers and leaves of different pines (Fig. 2, B), as well as of a fir, probably it is not derived from one, but from several species of both genera, just as the recent resin in trade is obtained from various species of *Pinus*. Three pines with two needles (*Pinus silvatica*, *P. baltica*, *P. banksianoides*), one kind with five needles (*P. cembrifolia*), and one fir with plain needles (*Picea Engleri*), similar to the *P. ajanensis* of East Asia, have been described as occurring in succinite. Concerning the name of the succiniferous trees, it must be remembered that we are often obliged in palæobotany to label single organs of a plant with special names, although some of these may belong together. Therefore it is necessary to give a peculiar name also to the pine-wood enclosed in succinite, because it is unknown to

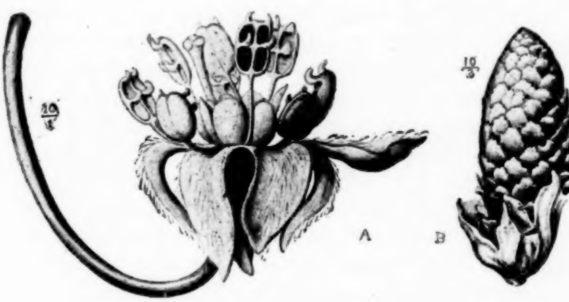


FIG. 2.—PLANTS INCLUDED IN AMBER.

A, Flower of *Cinnamomum prototypum* (after Conwentz "Angiospermen des Bernsteins"); B, Male flower of *Pinus Reichiana* (after Conwentz "Bernsteinbäume").

which of the above-mentioned leaves it belongs. Formerly it was called *Pinites succinifer* by Goeppert; however, I have proved in my monograph that there is no difference between that fossil wood and the wood of the recent genus *Pinus*, taken in a wider sense, wherefore the proper name should be *Pinus succinifera*.

Those amber forests, of course, did not consist of pines and firs exclusively, but also of *Thuja*, *Biota*, *Taxodium*, and other conifers. Moreover, there existed a considerable number of other trees, shrubs, and herbaceous plants, which I partly described and figured ten years ago ("Angiospermen des Bernsteins," mit 13 Tafeln, Danzig, 1886). First of all, there are some Monocotyledons, chiefly palms, for instance, an incomplete male flower of a date-tree (*Phœnix Eichleri*), some impressions of *Sabal*-like leaves, and so on. Added to these

are remains of other families, such as female and male flowers of *Smilax baltica*, a little fruiting spadix of a kind of *Calamus* (*Acoropsis minor*), etc. However, many more Dicotyledons are represented in the succinite flora. Particularly do single incomplete or complete inflorescences of oaks occur pretty often, and a good number of species of that genus (*Quercus*) may be distinguished; also several leaves of oaks are known. It may be mentioned that the underside of the leaves and other organs of oaks are covered with stellate hairs, which, becoming free by the friction of the leaves one against the other, must often have filled the whole atmosphere of the forests of those days. The hairs were often carried against the succiniferous trees and came in contact with the resin, in consequence of which we meet them now very frequently in the pieces of succinite. Again, there are flowers of Spanish chestnuts (*Castanea*), a beech-like fruit (*Fagus succinea*), and leaves like those of *Myrica*.

Of the greatest importance are the remains of Lauraceæ, as they belong to the most characteristic plants of the succinite vegetation. One leaf of a cinnamon tree has been known for a long time (*Cinnamomum polymorphum*), and I have figured both surfaces of it in the second-named publication. It was in the possession of a merchant of Danzig, and was sold a few years ago for £50. Certainly this piece is of great interest; however, a more scientific value attaches to another specimen, including a flower of a cinnamon tree, which shows the anthers with valvate dehiscence and other details very well, (*C. prototypum*, Fig. 2, A); it belongs to the Natural History Museum of Danzig. Many other flowers also of laurels have been described and figured. Further must be mentioned a beautiful impression of a large leaf, quite similar to our Magnolias (*Magnoliphyllum balticum*), and two kinds of flowers of Ternstroemiaceæ. One is a magnificent flower of a *Stuartia*, the diameter of which is 28 mm., the second a group of flowers of a *Pentaphylax*, which I have called *P. Oliveri*. Moreover, there have been found various flowers of holly trees (*Ilex*), two sorts of stamens like those of *Deutzia*, and flowers of other Saxifragaceæ, which could not be identified with recent genera. Sometimes *Daphne*-like leaves (*Eudaphniphyllum Nathorsti*) and other leaves which may belong to the Proteaceæ are to be found. The families of Connaraceæ, Papilionaceæ, and Ericaceæ are also represented. Besides these a few flowers of Myrsinaceæ, an impression of an Oleander-like leaf (*Apocynophyllum*), some flowers of *Sambucus* and of various Santalaceæ have been described, and last, but not least, small branches and inflorescences of Loranthaceæ, chiefly those of an *Arceuthobium*-like appearance. We may, therefore, conclude that some mistletoes existed already in the amber period, and probably decorated the tops of the succiniferous pines and firs.

What is, however, the geological age of this amber period? I have mentioned before that the Blue Earth of Prussia, which contains the succinite as well as loose woods and various marine animal remains,

belongs to the Lower Oligocene. Of course, the trees which produced the resin and the other organisms enclosed by it must have existed earlier. For this reason we may, I think, assume that the amber forests flourished in the Eocene period. It follows that the plants of those forests are not at all the same as those of the recent European flora, but rather that they bear a strong resemblance to the present native plants of East Asia and North America. That is to say, there many types of the oldest Tertiary remain still, while in our countries all the vegetation of that time has been destroyed by the glacial period. In England, however, the love and appreciation of parks and gardens is so great, and also the climate is so temperate, that we find in this country a good many of the very same trees and shrubs of East Asia and North America. It is interesting, therefore, to think that people in the amber district of England are surrounded even now by a vegetation partly resembling that of the amber period.

In conclusion, in thanking all those ladies and gentlemen who have had the kindness to assist my inquiries after succinite in England, and who have presented many a notable piece to the Natural History Museum of Danzig, which is under my charge, I should like to add that I shall be greatly interested to hear of new and remarkable specimens occurring in any English locality.

H. CONWENTZ.

II.

What shall we do with our Local Societies?

WHEN the votaries of science in all parts of the country are thinking of the national association for the advancement of science, it may not be amiss to consider briefly what is the essence of that science which the British Association is established to promote, and in what new way the association and other kindred but less influential bodies may yet take further steps in advance.

As Huxley often insisted, scientific knowledge only differs from ordinary knowledge in its greater precision, and science consists of such precise knowledge systematised. Mere guesses or unverified gossip cannot be dignified by the name of scientific knowledge, nor can the mere accumulation of facts, however precise, if not grouped round general principles, constitute a science.

Now, we have at our command a vast number of observers capable of adding to our stock of scientific facts, and many thinkers capable of generalising from these facts, though the work of both classes is in danger of being wasted or rendered virtually nugatory by want of organisation.

If one is engaged on research referring to some particular district he can readily turn to the publications of the local society or societies, though even in this case he may overlook some of them owing to their number, their unfortunately short life, or the limited publicity of their publications. Even with reference to such local work one may sometimes be tempted to wish that there had never been a field club at Stubbleton or Blankham, when a complete set of their *Transactions*, the precise value of which is an entirely unsolved problem, is neither to be found in the local library nor in that of the British Museum. This feeling, however, becomes far stronger when an Egyptologist hears of a paper recording original work on hieroglyphics in the *Proceedings* of the Shropshire Natural History Society, or when a meteorologist is referred to some valuable tabulated records of West Indian weather in the *Transactions* of the City of Lincoln Literary Club.

Science will, however, be benefited far more by an increase in the total number of local societies than by their suppression, provided only that their work be directed into useful channels and that their results be systematised. Much valuable work in most

branches of science may be done by isolated students ; but among the chief functions of local societies would seem to be (i) the education of a neighbourhood to some appreciation of science; (ii) the encouragement of beginners or of diffident and otherwise isolated students by the stimulus of rivalry, discussion, or co-operation ; and (iii) the corporate record of local observations undertaken perhaps by many members. As a good illustration of this last function, the twenty years' record of the Marlborough College Natural History Society in botany, ornithology, entomology, and meteorology, or rather in meteorology and in the phenology of plants, birds and insects, may be instanced. Though contributed to by many (by many generations, we may say, in a scholastic sense), we owe this valuable scheme in its entirety to the Rev. T. A. Preston.

Whilst it is educationally desirable that at least every considerable town should have its local society, one of the first necessities of the case, if such societies are to contribute to the real advancement of science, would seem to be the precise demarcation of the area over which the systematic observations of each society are to extend. If not absolutely necessary for each town or village society, when these small bodies do not publish, this topographical position is essential in the case of every county club or larger district association. The ideal at which we should aim in this matter is the partitioning of the whole kingdom between various societies. Rutland, Huntingdon, Monmouth, and Westmoreland seem to be the only counties in England at present without some natural history society; but in many other counties there is no body recognising the whole county as its area of study. The county is, of course, by no means a scientifically ideal unit of division, but it appears to be the most practical. For many of the purposes of the natural history recorder the river-basin is far better ; but if it is easier to arouse public interest and to ensure an *esprit de corps* in a county than in a river-basin, it will generally be comparatively simple to distribute the county records under river-basins, and so ultimately to secure, perhaps, a national census on the more scientific basis.

As has been pointed out elsewhere by the present writer (*Science Gossip*, June, 1896), it would add a desirable precision to their observations if every local society adopted a definite area of study ; but, to avoid discontinuity in our records and useless duplication of observation, this is far more essential for all publishing societies. While for the sake of the facilities for winter evening meetings and cheap short-distance field meetings it is desirable to multiply local societies, it is not by any means necessary that they should all print "Transactions," or in fact anything except, perhaps, an annual report. Probably most of us who have had to hunt through local "Transactions" will agree that one publishing society for natural history in each county is amply sufficient. Here the example long ago set by Yorkshire is most valuable. In May, 1864, the West

Riding Consolidated Naturalist Society comprised six societies within an area of twenty miles, numbering more than two hundred members. For them primarily *The Naturalist* was started, and between 1865 and 1867 three goodly volumes were issued from Huddersfield. Then, unfortunately, the journal died from want of support, coupled with too low a price having been placed upon it. In July, 1872, however, it was rehabilitated for a short time as the *Yorkshire Naturalists' Recorder*, and since 1875 has appeared continuously as *The Naturalist*, while there were in 1878 no less than twenty-seven societies in the Yorkshire Naturalists' Union. Union is so truly strength that these Yorkshire naturalists have been able not only to maintain this interesting little monthly journal, but also to issue valuable *Transactions* in which have appeared such substantial works as Lees and Davis's "West Yorkshire" and J. G. Baker's "Flora of North Yorkshire."

A county union, or one embracing several of our smaller counties, and made up of delegates from each society, could arrange committees for joint investigation, and select papers for publication from among those laid before the constituent societies. In this selection it may well be hoped that they would be more likely to choose exclusively local matter than a body more narrowly local and perhaps, therefore, more amenable to purely personal considerations.

Joint publication is by no means the only object, however, of such unions. In the inaugural meeting of a south-eastern union of scientific societies, held at Tunbridge Wells last April, under the presidency of the Rev. T. R. R. Stebbing, F.R.S., it appeared that the ideas of the founders did not, at first at least, even include joint publication, but that the notion of union had sprung from the interchange of geological lantern-slides and a wish for joint field meetings, and, possibly, the re-reading of interesting papers at various centres.

These were only some of the uses of union that appeared in the initial stage, and the main object of the present paper is to suggest that such unions may not only tend to greater precision of work, economy of labour, and publicity of results, but may also afford a valuable means by which the smallest local societies, with their otherwise isolated observers, may be brought in touch with more central institutions, such as the Selborne Society, the Commons' Preservation Society, and, above all, the British Association. The peripatetic character of this great association does much in this direction for our largest towns, and the committee of delegates from those local societies that publish, which meets annually by its invitation, has also greatly helped to spread the influence of the association annually into many channels ramifying over almost all the country. There is still, however, a want of systematic completeness in the carrying out of this scheme, which might be to a considerable extent supplied by county associations, or unions embracing several counties.

It is most important that large erratic boulders, earthworks,

megalithic monuments, natural springs, well-borings, earth-tremors, all meteorological phenomena, the migrations of birds, etc., should be systematically recorded over the whole country, and no better means for securing this result can be desired than the British Association committees. There is probably, however, not one of these committees that does not experience the lack of observers in many outlying districts. If the many societies of Lancashire were to follow the example of those of Yorkshire, those of the northern, eastern, and south-western counties to act on the initiative given at Tunbridge Wells, and what union there may still be between those of the Midland counties were to be consolidated and extended over the whole area, much would have been done.

It will be an important question for the South-eastern Union to decide whether they will not do well to enroll private members as well as delegates, a means of raising funds which is adopted by the Yorkshire Union; but next year's meeting, which is to be held again at Tunbridge Wells, though the congress is intended after that to be migratory, will have many other initial questions to decide. Meanwhile, it is much to be wished that at the Liverpool meeting of the British Association something may be done to encourage a step forward in the direction of a closer bond of union between organisations scattered over the whole country and the association itself.

It is hardly necessary to add that no system of unions or associations need involve any loss of independent self-control on the part of any local society.

G. S. Boulger.

[As we understand from Mr. George Abbott's letter to Sir Douglas Galton, which was read at the Tunbridge Wells Congress above mentioned, Mr. Abbott is in thorough sympathy with Professor Boulger's views. He has, in fact, sketched out a complete scientific organisation, and one not to be despised, although perhaps it rather recalls the method and precision of which French philosophers are proud than the somewhat random growth of most English institutions. He desires that the whole of England should be partitioned among a small number of scientific unions, in intimate connection with the British Association, as the supreme directing body. The area of each union would be similarly partitioned into districts allotted to the several component societies. Of these societies each would nominate an honorary corresponding member in every village of its district. Supposing the whole machinery to work with that perfection which the enthusiasm and philanthropy of its conception demand and deserve, all the people of this land will before long be brought into touch with "natural knowledge." They will learn to observe and to record. They will learn to value and to preserve. From numberless eyes and hands science will receive and welcome the infinite details of investigation and research, while by the proposed interdependence of all the parts of the body corporate, the control of experience and learning will be available to shield the ignorant and the beginner from the risk of publishing what is erroneous, of republishing what is already perfectly well known, or of hiding away in some obscure publication results that are really important.—Ed., Nat. Sci.]

III.

A Zoologist in Tierra del Fuego.

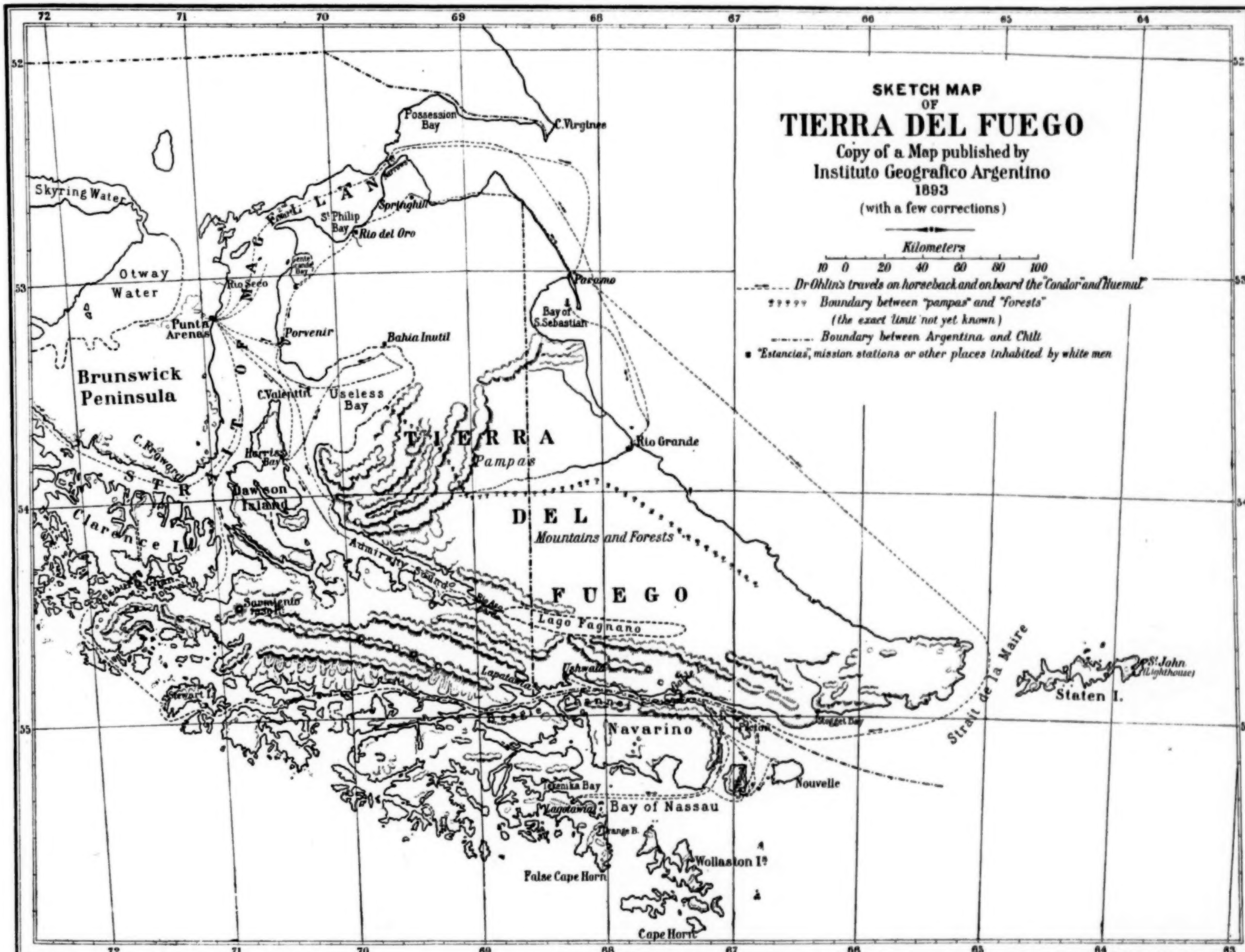
SOME ACCOUNT OF THE SWEDISH EXPEDITION, 1895-6.

THIS article is merely a short account of excursions made during this expedition, with a few remarks concerning the geographical distribution of some South American animals. Since all our collections are not yet in Sweden, it is impossible to make more than a rough classification, so that the results at present are only of a general nature.

The expedition—consisting of Dr. O. Nordenskiöld, as geologist and leader of the party, P. Dusén, civil engineer, as botanist, and myself as zoologist—was organised, mainly at the expense of Baron Oscar Dickson, to obtain, from an easily accessible country near the true Antarctic region, collections to be compared with those in the Riksmuseum at Stockholm, brought from the Arctic Seas, Spitzbergen, Greenland, and Siberia by other Swedish parties. As was to be expected, the original intention of working together had to be given up even at Buenos Ayres, where, in October of last year, Mr. Dusén, Mr. Åkerman (engaged as assistant zoologist), and I went on board the Argentine torpedo cruiser "Patria," bound for Tierra del Fuego, leaving Dr. Nordenskiöld and the pioneers to wait for another opportunity.

At the end of October we left La Plata. My expectations of being able to make some zoological investigations along the little-known east coast of Patagonia were not realised, as the vessel stopped only at Puerto Nuevo, harbour of Chubut, lat. 42° 45′ S., long. 64° 59′ W.; at Santa Cruz, lat. 50° S., long. 68° 32′ W.; and at Rio Gallegos, lat. 51° 40′ S., long. 69° 18′ W. The "Patria" stayed at Puerto Nuevo a week, so that I had opportunities to dredge and to collect some terrestrial animals; at the other two places I only picked up a few invertebrates from the beach and the land. However, though my collections are so small, I hope they will add somewhat to our scanty knowledge of the fauna of the Atlantic coast of Patagonia.

It is evident that great differences must exist among the marine faunas of these two countries, owing to the ocean currents—the cold



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Antarctic along the west coast, and the tropical Brazilian southwards as far as the Strait of Magellan, possessing, according to Popper, a mean temperature of 10° C. The contrasts among the land fauna must be even greater, as the great differences of climate and of geological and physical structure necessarily exercise a considerable influence on the organic life in these regions.

I arrived at Punta Arenas (Sandy Point, lat. 53° 10′ S., long. 70° 54′ W.), capital of the Chilian territory Magellanes, on November 20, and spent a month, pending the arrival of Nordenskiöld, in making as complete a collection as possible of representative land and marine types, especially of insects, spiders, and freshwater animals, since I knew that these classes had not been taken by naturalists like Darwin, Cunningham, and Coppinger, who had previously visited Tierra del Fuego; nor, as I learnt at Punta Arenas, had the recent investigators, Dr. W. Michaelsen, in 1892, and Dr. L. Plate, in 1894-5, given them sufficient attention. My studies here were the more interesting to me, since Punta Arenas lies more or less on the boundary of the two Patagonian provinces, which differ in almost every respect. On the one side, to the east, may be seen the typical Patagonian landscape, the poor, arid, and very windy pampas; on the other, westward, the rainy Pacific coast, covered with immense, nearly impenetrable forests of evergreen beeches and a variety of vegetation, and having a temperature varying but slightly in summer and winter. In fact, a remarkably distinct line of demarcation is to be found between the east and west climatological provinces, some few miles to the west of Punta Arenas. East of Cape Froward, the climate belongs to the "pampas type," west of it to the extremely-pronounced South Chilian coast type.

In view of these circumstances, I deemed it worth while to stay in Punta Arenas, in order to ascertain whether the animals of the one zoogeographical province meet with those of the other. So far as my own observations may permit me to judge, I think this is the case in the vicinity of Punta Arenas; here I can mention only a few of the more obvious instances to support this belief, but when all the collections have been worked out I have no doubt that additional evidence will be forthcoming.

Among spiders the occurrence is striking of a large Lycosid, probably *Lycosa australis*, Simon, which I found rather abundantly later on in the southern districts of Tierra del Fuego, in its forest-regions, and in the southern and western archipelagoes, but looked for in vain among the pampas of Patagonia (at St. Cruz and Rio Gallegos), and of Tierra del Fuego. On the other hand, at no place south of the Strait, nor in the western archipelago, nor at Punta Arenas, could I find any specimen of a scorpion, which I met with for the first time at Chubut, and afterwards at Santa Cruz and Rio Gallegos. This seems to prove that it belongs exclusively to the pampas; yet I should not be at all surprised to find some specimens near Punta Arenas, as I

learnt, during a visit to Ultima Esperanza, which is but 1° farther north, that a scorpion, apparently of the same species, was not rare there. It seems to me strange that I have never heard or read of the occurrence of myriapods so far south from naturalists who preceded me in this country, as I observed a species, probably a Lithobiid, at almost every place where I landed—along the eastern and western Patagonian coast from Santa Cruz and Ultima Esperanza to the Strait, at Punta Arenas, in Tierra del Fuego (both in the pampas and in the forests), and in the southern archipelago as far south as Tekenika, some miles north of Cape Horn.

Again, among vertebrates I should like to call attention to the singular distribution of a lizard, doubtless identical with *Ptygoderus pectinatus*, Dum. and Bibr. (=*Proctotretus magellanicus*, Hombr. and Jacquin.). Darwin remarks that no reptiles have been found at Tierra del Fuego, though they may exist, he says, as far south as the Strait of Magellan. Indeed, even Hombron and Jacquinet mention in their "Voyage au Pole Sud," Zoologie, t. iii., p. 6, the occurrence of a small lizard at Peckett Harbour, on the northern shore of the Strait. Cunningham procured specimens of the same species at Rio Gallegos and many other places in eastern Patagonia, and afterwards observed it for the first time at Philip Bay, on the northern coast of Tierra del Fuego. I myself found it fairly often along the northern and eastern coasts of this great island within the pampas region, and secured two specimens as far south as Rio Grande, lat. 53° 50′ S., the most southerly spot on the globe where reptiles are as yet known. Darwin, in fact, advanced the entire absence of reptiles south of the Strait as an argument in favour of his theory that the Strait was to be regarded as the distinct boundary between two entirely different faunas, and that Tierra del Fuego had no, or very few, species of insects, spiders, and other terrestrial animals occurring in Patagonia. In regard to insects, especially Coleoptera, it is mainly by the examination of the valuable collections brought back by the French "Mission scientifique du Cap Horn, 1882–83," that Darwin's view is proved erroneous. The observations of Cunningham and of myself also contradict his view as to the distribution of reptiles. Although the lizard referred to above evidently belongs to the pampas, it occurs as far west as Punta Arenas, where Cunningham found a specimen, though I was not successful in my search for it.

Another striking example of the tendency of pampas animals to go farther west towards the forests is the armadillo. During my stay at Punta Arenas, in February, a specimen was found for the first time, walking *con toda tranquillidade* through the main street of this town; however, as it was killed and thrown away before I had a chance to examine it, I cannot say to what species it belonged. At Santa Cruz and Rio Gallegos armadillos are said to be rather abundant.

Here I may remark that on several December evenings I observed a bat flying round among the old and hollow beeches on the

hills above Punta Arenas, which I vainly tried to catch in order to ascertain the species. This is, so far as I know from the literature, the first time that any representative of this order has been met with so far south. I did not see bats in Tierra del Fuego, nor did I hear them spoken of as occurring south of the Strait of Magellan. I believe the species will eventually be found to belong to the Chilian fauna, thus extending along the Pacific coast, within the forests, very far south. This would not be at all surprising, since we know that some true tropical and sub-tropical birds have a very extensive range along that coast. Another interesting fact is the very strange distribution of a parrot (*Conurus smaragdinus*, Gmel.) which I observed in great flocks in the forests near Ushuwaia, at the Beagle Channel, in lat. 54° 49′ S., long. 68° 18′ W.; a humming-bird (*Eustephanus galeritus*, Molina) has also been observed by former naturalists, among others by Cunningham, Coppinger, and those of the "Challenger," and mentioned as occurring very commonly on the islands of Smith Channel and of the western entrance to the Strait.

To birds I did not pay special attention, as almost every naturalist, who visited these countries before me, was interested in ornithology. In fact, in looking into the excellent memoir on birds from Patagonia and Tierra del Fuego, published in the "Mission scientifique du Cap Horn, 1882-83," t. vi., p. 3, by Oustalet, one finds, at the very first glance, that the ornithology of Tierra del Fuego must be regarded as thoroughly well worked out. A more practical reason why I did not collect many birds was that my time was too short to allow me to spend possibly one or two days in skinning them. Besides, I consider even a fairly complete collection of birds, mammals, or other higher animals, to be, from a scientific point of view, of very little value, unless the naturalist has an opportunity at the same time of making careful observations on the biology of the species collected. Such an undertaking, to be exhaustive, requires at least one or two years' residence in one limited district. Moreover, as the breeding season of most birds was already past on my arrival in this country, I thought it more advantageous to spend the few months which were at my disposal in collecting other classes neglected by former naturalists. Still, a good many birds were shot during my later voyages in the Fuegian Archipelago, but as a rule I did not skin them, merely putting them directly into alcohol for future osteological or anatomical study.

In Punta Arenas, I secured a small collection of Rodentia, just as Nordenskiöld did in the eastern parts of Tierra del Fuego. I also picked up all remains of seals and whales as far as circumstances permitted, because these mammals are worth careful investigation, the last mentioned especially, for the sake of comparison with northern and Arctic species. From the same neighbourhood I got together what I hope I may call a rather complete collection both of marine and terrestrial invertebrates. Nor did I forget to look out

for the freshwater pools, the fauna of which, I knew, had been so far very little studied. From the beach I got many interesting forms, and my dredgings in the vicinity of the harbour—carried on, during the first stop here, from the steam launch of the Chilian man-of-war "Magellanes," which the governor kindly put at my disposal—yielded specimens representative of the fauna living at different depths at the bottom of that part of the Strait.

I did not pay much attention to species already well known as characteristic of this zoogeographical province, and of a larger size, or possessing some other quality which might make them of value to museums; but, on the other hand, I was very much interested in the representative forms—that is, such animals as are to be met with both in the Arctic and Antarctic seas, but not in any of the intermediate oceans, sometimes resembling one another so much as to allow of no specific distinction, sometimes offering modifications so slight as to necessitate their being considered as varieties only.

The recent expeditions to the southern seas, among others the French "Mission" and the German expedition to South Georgia, 1882-83, have contributed greatly to our knowledge of these interesting forms. My collections, I am sure, will be found to contain some forms, at least of crustaceans (mainly the amphipods), and of hydroids (with whose Arctic representatives I am somewhat familiar), belonging to the same genera or even, I venture to say, to the very same species as occur in the North Atlantic or Arctic Oceans.

En passant, I would like to mention the occurrence in the Strait of Magellan of a *Nebalia*, which, after a rough examination, seemed to me very like our Greenlandian and North Atlantic *Nebalia bipes* (O. Fabr.). I think this is the first time any representative of this highly interesting and phylogenetically important order of crustaceans has been observed in the southern hemisphere. I found it rather common on the sandy *playa* at Punta Arenas, under stones, etc.; afterwards I got specimens, possibly of the same species, in the trawl at moderate depths in Admiralty Sound and in the western part of the Strait. I also carefully collected all forms belonging to classes not worked out by previous expeditions, *e.g.*, Tunicata, Annelida, Nemertinea, Turbellaria, Amphipoda, Entomostraca and Cœlenterata. Having read the vivid descriptions by Darwin and other naturalists of the numerous and varied forms living in abundance in the kelp-forests (*Macrocystis pyrifera*, Agardh) of the Antarctic Seas, I expected to find among that magnificent seaweed a rather interesting and easily accessible field for research. In this hope I was, however, greatly disappointed; for I am sure that in our zone of *Fucus* and *Laminaria* there is a more abundant animal life, both as regards the number of species and of individuals. As to the towing-net, I am sorry to say that I did not have much chance of using it, mainly on account of the windy, unfavourable weather which prevailed.

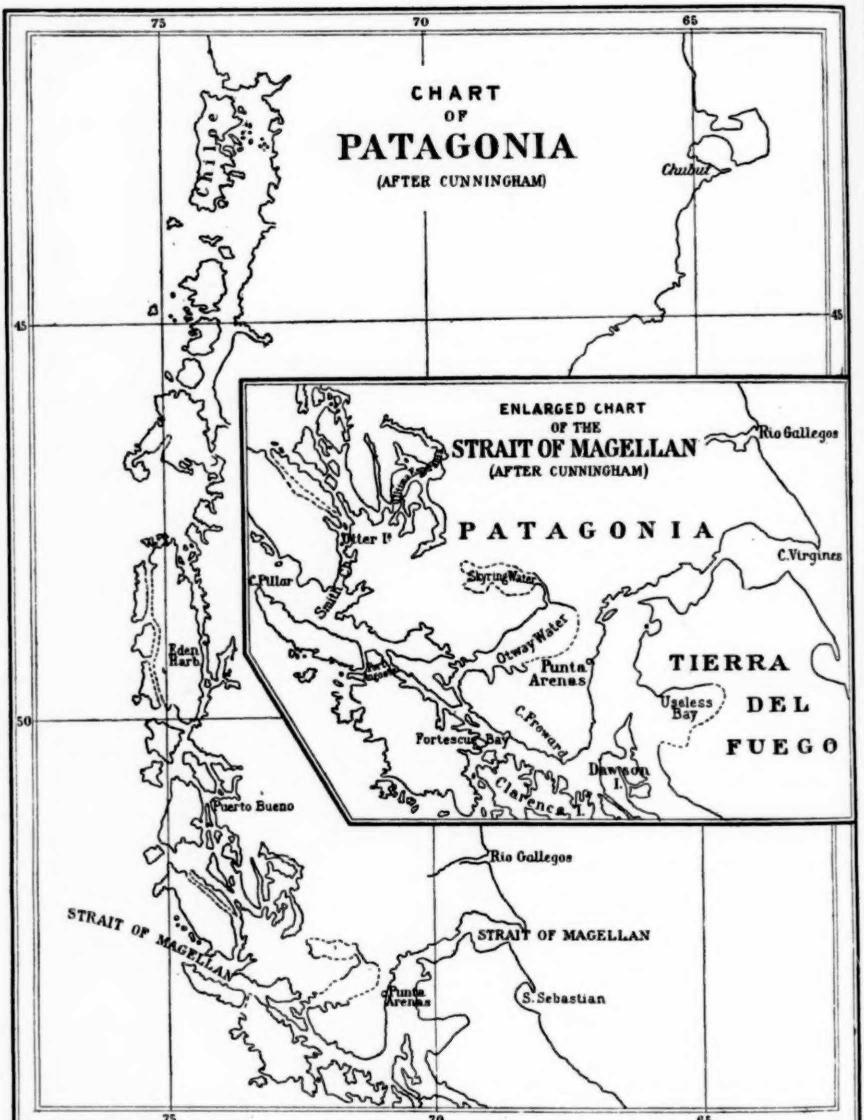
About December 15 Nordenskiöld and the pioneers arrived at

Punta Arenas by way of St. Sebastian and Porvenir, and the whole expedition started for the east of Tierra del Fuego. On New Year's day, after a long and wearisome journey on horseback, we reached Paramo, a small gold-mining settlement on the bay of St. Sebastian, lat. 53° S., long. 68° 15′ W. During this journey I did not collect much; those familiar with this kind of travelling will understand that after some ten or twelve hours' riding, without food or water, one prefers to rest, on arriving late at night, at an *estancia* or some good camping-place. The only collection of some importance that I made along the northern and eastern coasts was at Gente Grande Bay, where we spent Christmas, and where I had some time for dredging. Here, too, I had opportunity to observe the guanacos (*Auchenia huanaco*). These animals are rather abundant in Patagonia: in the pampas near Punta Arenas they sometimes occur in herds of some hundreds. Though they are found in the pampas district of Tierra del Fuego, and even to the south of Lago Fagnano and Rio Azopardo, and, according to the *mineros*, in Navarino Island, yet they must be regarded as comparatively scarce to the south of the Strait. While the guanaco might, therefore, be considered as furnishing an argument against Darwin's view before referred to, the ostrich (*Rhea darwini*) is apparently an argument on the other side, it being found all over Patagonia, though not to the south of the Strait, and being replaced north of Rio Negro, lat. 40° S., by a closely-allied species, *Rhea americana*. The puma, again (*Puma concolor*), is common in the great forests near Punta Arenas, where the Indians trade in its skin, but has not been observed south of the Strait or in the archipelagoes. From the eastern pampas of Tierra del Fuego I secured a few specimens of a fox (*Canis magellanicus*), which occurs also in Patagonia, and a number of Rodentia. The troublesome little "tuco-tuco" (*Ctenomys magellanicus*) is extremely abundant in the northern and eastern parts of Tierra del Fuego, and in the pampas of southern Patagonia, being replaced farther north by other species, *C. brasiliensis*, etc. It forms one of the chief articles of food of the Onas Indians, whose women are very skilful in catching it. These also I have never heard spoken of as occurring south of Admiralty Sound, or in the southern and western archipelagoes; they may, therefore, I think be considered as belonging exclusively to the pampas of Patagonia and Tierra del Fuego. The French expedition to Cape Horn brought back ten species of Rodentia, most of them from Santa Cruz, and only four species from the Bay of Orange. It will be interesting to see if any of those that we secured from the east of Tierra del Fuego or from Punta Arenas are found to be identical with those from the southern archipelago.

The two weeks at Paramo I occupied chiefly in collecting insects and *playa*-forms. The other members of our party left on January 8 for the mission station of Rio Grande, from which Nordenskiöld intended to start for the interior and the Cordilleras. Unable to obtain a boat for dredging purposes, I paid a short visit to Rio

Grande, and returned in the middle of January to Punta Arenas on board the "Condor." During trips to Useless Bay and Dawson Island and to Rio Seco, the dredge yielded a number of interesting forms, but the most valuable collections were obtained on a voyage of three weeks' duration to the southern archipelago. On this trip, which started on February 1 and was favoured by fine weather, I was able, through the kindness of Captain A. Fontaine, to make excursions ashore whenever I liked, and to dredge at some twenty different places in Beagle Channel and round the Islands of Navarino, Lennox, and Picton. I dredged as far west as Stewart Island, lat. 54° 5′ S., long 71° 29′ W., and south at Lagotowia in Tekenika Bay, some 30 miles north of Cape Horn. It is to be regretted that I did not reach a depth of 100 fathoms or more, but the currents were too strong (in the First Narrows of the Strait the tide sets at seven to ten knots an hour) to allow my small light trawls, even with supplementary weights, to reach the bottom. By dredging on the sea and collecting on land, I think I gathered a fairly representative collection of marine and terrestrial fauna. Spiders are singularly abundant, both in number of species and of individuals. Some species of phalangiids of strange appearance and remarkable size were found at Lagotowia and a few other stations. I may mention here the occurrence at Ushuwaia and at Gable Island of a Limaciid, the first representative of the family observed so far south, though, strange to say, I did not find it elsewhere. The weather not being quite so fine on our return journey, I was unable to dredge in the Atlantic as I had hoped. At St. Sebastian we called for Nordenskiöld and the others, and arrived at Punta Arenas again on February 19. Both in the Strait and at Porvenir I secured specimens by dredging.

On our initial programme the exploration of Lago Fagnano, which has never before been attempted, was put as one of the most important items after the researches in the eastern parts had been carried out. This large freshwater lake was discovered three years ago by the Chilian-Argentine Boundary Commission, and is represented on maps as about 90 kilometres in length, 10 to 15 in breadth, and in some places 90 fathoms deep. Its axis is from east to west; it is situated at the northern slope of the Cordilleras, and connected with Admiralty Sound by Rio Azopardo. The whole expedition started on February 25 for Admiralty Sound. At Rio Condor Dusén found a specimen of humble bee, probably *Bombus dahlbomii*, which has never before been observed in Tierra del Fuego. Three days afterwards we arrived at Rio Azopardo, and, trusting the information given us by the chief of the Boundary Commission that we would need only one day to go up the river, Nordenskiöld ordered the vessel to call for us in twelve days. Then he, Åkerman, I, and four others started at once for the lake, while Dusén and the rest stayed at our camping-place on the shore. However, we found that the difficulties of ascending the river with a boat laden with a heavy cargo of tents, provisions, dredges,



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tools, etc., were far greater than we had expected. Having traversed with great hardship three-fourths of the distance, we arrived on the fifth day at a waterfall, at least three metres high, and beyond that, we sighted a long series of rapids, stronger than those lower down. Consequently, we deemed it impossible to reach our destination in the short time at our disposal, either by water or by carrying the boat and its cargo through the thick vegetation bordering the river. The return journey down the river to the encampment, with the tide in our favour, occupied only two hours. Thus I had to return after having only sighted from a distant hill that beautiful basin which will, no doubt, some day prove very interesting for research, notwithstanding its analogy with some of our "relict-lakes." During my twelve days at Admiralty Sound, the weather was too bad to permit of my making any but terrestrial and freshwater collections; however, I dredged later on at a depth of 100 and 150 fathoms respectively at Martha's Bank and Cape Valentin.

Having by this time a good representative collection of the eastern fauna, I thought it would be interesting, for the sake of comparison, to visit the west of the Strait and the Pacific coast, and, through the courtesy of the Governor in Punta Arenas, Mr. Señoret, I was invited to start on board the "Huemul," sister boat to the "Condor," for Ultima Esperanza, a fiord never before explored by naturalists. Ultima Esperanza is the Spanish name of that very strange coast feature connected with Smith Channel by a narrow sound and by two narrower passages several miles apart, one of which is only 30 metres broad in some parts, while the other is rendered unnavigable by reason of several boulders just in the narrowest part. The tide sets through Kirke, as the northern passage is named, at the rate of ten or twelve, in spring even fifteen, knots an hour. At Isthmus Bay I found two tadpoles, probably *Nannophryne variegata*, Günther. Their occurrence along this coast has, I presume, been mentioned first by Cunningham, who found them at Eden Harbour and afterwards at Puerto Bueno, where he also met with another species, *Hylodes leptopus* (Bell); at present, then, Isthmus Bay is the farthest point south at which batrachians are recorded. They are another instance of the extension of terrestrial forms, originally sub-tropical, along that part of the South Pacific coast remarkable for its excessive rain and slight variation of mean temperature in summer and winter, and, as a result of these, for its luxurious vegetation. I should not be at all surprised to find this frog as far south as Cape Horn, just as other forms have so wide a range as from Chiloe Archipelago to Cape Horn, 800 to 900 miles. On arrival at the fiord, I found the water rather brackish, and, as I had expected, dredged at first with very little result—two mussels, a few annelids, a couple of amphipods and sea-stars. Therefore, I was the more surprised to find on the last day, when dredging in ten fathoms, numerous sponges, worms, amphipods, echinoderms, and a species of Cumacea. These were

mostly quite new to me, and this was the only occasion on which I found Cumacea, an order so characteristic of Arctic and northern seas. It will be interesting to discover whether these forms are characteristic of these remote waters, or whether they are also found in the outer parts of the southern Chilian Archipelago, in which case they must have been pressed in the embryo stage by the tide through one of the two passages into the almost fresh surface-water of Ultima Esperanza.

In other respects, which I can only enter into briefly, was this inlet interesting. It was remarkably rich in waterfowl; the beautiful black-necked swan (*Cygnus nigricollis*, Gmel.) was far more abundant here than near Gente Grande Bay, where I had observed numbers before. Also worth recording was the unexpected appearance of a great shoal of whales in the innermost water, which was so fresh that the sailors used to drink it. So close were they that I recognised them as belonging to the Mystacoceti, and probably to the genus *Balænoptera*. Their size was estimated at about 50 feet; they were blackish in colour and the back was provided with a high and pointed fin, so that at a distance they resembled our northern *Orca gladiator*.

In regard to spiders and insects I was glad to find several species not met with in Tierra del Fuego, though possibly in part identical with those of the south Chilian coast. Still, I believe there must be a good deal of difference between the terrestrial fauna of Ultima Esperanza and that of the exterior archipelago, seeing that the climate of the former is more like that of the eastern parts of Patagonia, that is to say, with less rain and greater differences between the mean summer and winter temperatures—climatic conditions which exercise a great influence on the fauna as well as on the flora. I regret greatly that I did not have time enough to make larger collections from this part, which, being quite unexplored, will yield interesting results to both the zoologist and the botanist; but on April 5 we were obliged to leave. Stopping at the Otter Islands and at Borja Bay to make collections, I reached Punta Arenas three days later, and arrived at Plymouth, after an absence from Europe of eight months, on May 17.

I may now add a few words as to how operations were carried on. I have before hinted at what I thought the most important points, viz., to visit countries hitherto unexplored, and especially such seas as seem from their physical structure to be highly interesting, *e.g.*, the Atlantic coast of Tierra del Fuego, Lago Fagnano, and Ultima Esperanza. I tried in vain to get an opportunity of visiting the Otway and Skyring waters, never explored, so far as I know, for zoological purposes. Another point is to secure, if possible, a thoroughly representative collection of well-preserved terrestrial and marine specimens from a limited district. Although I am well aware that Michaelsen and Plate, among other naturalists, have done excellent work just in the neighbourhood of Punta Arenas, I hope my collections may contain some forms overlooked by these two eminent

scientists, thus forming a useful complement to our knowledge of its fauna. Weak points in my collections, besides the small number of birds, the reason for which has been referred to, are the poor results from the towing-net and deep-sea dredgings, accounted for in great part by unfavourable weather and strong currents. During our expedition dredgings were carried on at thirty-six different places, to depths of from five to 150 fathoms, while terrestrial, freshwater, and *playa*-forms were collected at some thirty-three different localities at least. The towing-net was used at about fifteen places, and a number of fish were caught.

In regard to the preservation of the animals collected, it was only at Punta Arenas that I had time to use the new methods of fixation; most marine forms, therefore, I put directly into alcohol (70 to 80 per cent.) or into formalin (1 to 2 per cent.). The latter I found very good for fishes, tunicates, molluscs, annelids, echinoderms, and cœlenterates, but not for sponges, which I therefore put in spirit. Formalin preserved the shape very well, and in many cases the colour also. Animals caught in the towing-net or from fresh water I preserved by adding a few drops of 40 per cent. formalin to the water in the jar in which I kept them. Coleoptera (except very hairy ones), Hemiptera, spiders, and all larvæ I killed and preserved in alcohol. Other insects, such as Diptera, Lepidoptera, etc., I put into a bottle with cyanide of potassium, and afterwards kept dry in paper. I cannot yet speak of the quality of our collections, but I may give an imperfect idea of their number by mentioning that they are contained in some 1,300 jars, many of which had to be crammed with different species, owing to the difficulty of obtaining more glass jars in Punta Arenas. I hope, when all our material is worked out, to publish a fuller report, enumerating all localities visited, their position, physical relations, etc., and giving a historical review of all voyages to these parts, and a complete bibliography, as well as more detailed and accurate maps. The two maps accompanying this paper are drawn from an Argentine Government publication, and from Cunningham's "Notes on the Natural History of the Strait of Magellan and West Coast of Patagonia," Edinburgh, 1871.

Finally, I wish to offer my warmest thanks to the Chilian officers in Punta Arenas, especially to the Governor, Captain Señoret, and to Captain Gomez, of the "Errazuriz," who, with the greatest generosity, unparalleled in any country in Europe, put vessels at my disposal and gave me other opportunities of making trips. It also gives me pleasure to acknowledge my indebtedness to Captain Fontaine, Lieutenants Portaluppi, Valderrama, Sanchez, and the pilot, Mr. Hyden, of the "Condor" and "Huemul." Without their kind assistance, my zoological collections would have been worth very little.

Wisingsö, Sweden. AXEL OHLIN.

IV.

Casual Thoughts on Museums.

Part V.—Anthropology.

THAT some men and most boys are beasts we learn when we are very young from the ordinary conversation of schoolboys and draymen. The metaphor of these expressive rhetoricians is not only, as everyone knows, confirmed by sober science, but has been extended to all human beings. Man is no longer put in a separate order by himself, but is classed by the zoologist as the terminal link in the long chain of life. The mysterious secrets of that chain increase, instead of diminishing, with our knowledge, and its initial stages seem more puzzling than ever, for many of the keys and explanations of recent years resolve themselves into the substitution of one phrase for another, and it is not illuminating to substitute a red fog for a black one—but let that pass.

That man is a beast, allied by his structure, etc., to other beasts, is a scientific conclusion that has hardly yet penetrated into the museum mind, a mind which carries on the systematic study of life largely without any consideration of the one form of life about whose structure, variation and conditions we know most, namely, that form of which you and I are curious and perhaps unmatched examples.

Is it not a most remarkable fact that in this great empire of ours, with possessions in every climate and numbering men of all races among its subjects, we should not have a single example anywhere of an anthropological collection—I mean no collection in the least representing or worthy of the subject?

At Cromwell Road, and in some local museums, there are small and utterly inadequate and neglected and ill-arranged and uninteresting collections of human skulls and a few skeletons. At the Museum of the Royal College of Surgeons there is a larger collection of a similar kind, supplemented by a magnificent series of preparations of the internal organs and structure of human beings, and for the most part of morbid cases. But these are in no wise sufficient. They seem at present to exist merely for the purpose of exasperating the typical systematist, who hates internal *differentiæ* and loves to class his beasts by the presence of patches of colour in the hair or feathers. I do not mean by an anthropological collection a collection of dresses, weapons, tools, etc., used by savages, or of the gorgeous neckties and waistcoats of

modern times. These things, *mirabile dictu*, belong to the province of Art, and the province of Art, that is, of human handiwork apart from the work of Nature, is well represented at Bloomsbury; there, by the munificent generosity, vigilance, and zeal of my friends, Sir Augustus Franks and Mr. Charles Read, an incomparable collection, admirably arranged, of savage garniture has been got together. Why is it not more studied?

I am not speaking, however, of man sophisticated and spoilt by the livery of civilisation, but of man in his condition of primeval innocence and beauty. What I want to see in the Natural History and other similar museums are models of different races of men, showing their bodily features, their colour, their size, their shape, and so on, by coloured casts and models such as may be seen in some foreign museums—showing what kind of hair they have, what their facial contours are, the relative length of their arms, the fashion of their insteps, feet and toes, and supplemented by skulls and skeletons, the scaffolding upon which the real human contours have been moulded. In this way, and in this way only, shall we learn what are the affinities of man, and perhaps also what are the lines of his pedigree.

I am, I know, only reflecting the thoughts and wishes of Sir William Flower, who has for years been an advocate of this view, and who, now that he is packing away out of sight the collections of skeletons upstairs[1]—which are useless as exhibition objects, priceless as they are in the students' room—will have, it is to be hoped, accommodation for exhibiting a really representative and well-arranged collection of casts and preparations of the various forms of man. This long-needed, and, by some of us, long-clamoured-for addition to museum collections is now within a measurable distance of being commenced, and there ought to be many ready to help it on.

We ought to impress, as the German and French Governments impress upon their Colonial Governors, their frontier agents, and their civilian and military officers, that it is part of the duty of such men, in such positions, to help the National Museums in every way. On the other hand, the museums should, as they mostly do, put prominently before the public eye the names of their benefactors. If Darwin and Owen deserve statues in the National Museums because of their scientific attainments and reputations, assuredly Hume and Tweedale, Enniskillen and Egerton, Davidson, Godman and Salvin, and many others, deserve to have their munificence and public spirit recorded in "everlasting brass." It is pitiful also to think of the collections which have been sent home and are piled up, unarranged, unnamed, and useless, because it is not given to all curators to have the *Furor Sharpei* nor the *Patientia Woodwardi Junioris*, nor the *Pertinacitas*

[1] If my accomplished American critic thinks that the fact, the prime fact, that mammals as a class have five fingers and five toes can be illustrated by a long gallery full of mounted skeletons better than by a series directed *ad rem* as in the Index Museum, he will not make many converts here.

Murrayi, for instance. Nor is this all; other collections (two certainly) of carefully and beautifully made casts of natives of India have been sent to this country to two exhibitions, and have been allowed to moulder away into dust and destruction. It is these things, and things like them, that take the heart out of men who would be willing to help the museums in every way. The sort of men we want are men endowed with the never-ending zeal of such English representatives as my friend Johnston, the Governor of Nyassa Land, who sends bales of specimens home by almost every mail, and proves that the really condensed essence of human zeal, and perhaps goodness, is only to be found in little men.

And what lessons shall we not learn from a real anthropological collection? I do not mean merely in regard to *ad captandum* issues like the antiquity of man, or the actual links by which the Pucks of our nurseries are united with the Pucks in the Monkey House at the Zoo—these are more difficult questions than many men used to think, and those who know the most about them feel the most mystified—but in regard to simpler and homelier issues, in which it is so much more easy to experiment upon man, whose direct ancestors on either hand we have records of, and whose modes of life are more accessible to study—questions of sexual selection, which has been ridden to death as so many other *à priori* theories have by the wild Darwinians; questions of the fertility of hybrids; of the persistence of types; of the occurrence and inheritance of sudden variations, and sports like families of six-fingered or of left-handed men; questions of the effects of environment as apparently exhibited in the production of the Yankee type, with the sharply chiselled face and long wiry hair, so like in many ways to the American Indian; the effects of close interbreeding, the inheritance of disease, and the effects of the mere struggle for existence, another of the issues upon which many Darwinians have gone stark mad. A closer study of savage man would have saved some of them from the quagmire into which deductive reasoning generally leads the man of science. The fact that well-fed and healthy animals and plants are generally less fertile than underfed and unhealthy ones has been splendidly shown in the case of man. Then there is that other hobbyhorse of the deductive zoologist, conscious or unconscious mimicry. That butterflies and birds in South America should mimic for protective purposes butterflies and birds in Africa seems a puzzle to an ordinary logician who does not treat *post hoc* and *propter hoc* as synonymous. Here again we may profitably turn to the lesson taught by human examples. I do not want to indulge in paradoxes, and to deny the efficiency of many of the arguments used by Darwinians, when duly limited and when duly restrained. No doubt the causes cited are efficient causes to a certain extent, in some cases very slightly and in others more so, but what I say and have always said is, that they have been absurdly exaggerated, and made to do service in every fantastic way, and if we are to cure many of these mistaken

inferences we cannot do better than base our inductions more and more on man, of whom we know much, and meanwhile always keep before us as a warning the fruitful proverb, *omne ignotum pro magnifico*.

Even in regard to more critical problems, the study of anthropology in its proper inductive way, by bringing together types from various localities, promises much. If we are to be logical and consistent we must apply the same kind of *differentiæ* to distinguish men that we do to distinguish butterflies and birds, and give them the same value. Are not Esquimaux and Bushmen, Samoyedes and Australians, American Indians and Fantis, much further apart than any two species of monkeys, of larks, or of butterflies? That these various human species may have had a common ancestor who was human may be the case or may not. I am bound to say I know of very little evidence on the subject.

We know that in the caves of Brazil Lund found under the stalagmite the skulls of men whose facial type was like that of the American Indian, associated with the remains of the *Megatherium* and other extinct so-called Pleistocene beasts. In Europe we have found abundant remains of man also associated with the extinct beasts under the stalagmite of our caverns. Hence in so-called Pleistocene times it is clear that man existed both in the Old and the New World, and apparently differentiated as he is now differentiated on each side of the Atlantic. Further back than this we cannot at present go. We are told that the problem is one that is not to be measured by centuries, but, perhaps, by millions of years. I protest, not from any *à priori* prejudice, theological or otherwise, but simply because, having devoted a great deal of time and thought to archæology, I can see literally no evidence to justify such a conclusion. A great many thousand years ago, the types of man were apparently precisely what they are now. The Egyptian Fellah, the Hadandowah, and the Negro are all represented on the earliest monuments. Language also seems to get no nearer a common origin as we get further back, but rather the reverse. Sanscrit and Chinese, Babylonian and Egyptian, at the earliest stage to which we can trace them, are quite as far apart, if not farther, than any modern languages; on the other hand, when we get to the outskirts of human tradition and the records of language, we also get into a region of inquiry, where our archæological evidence becomes very scanty, and I see no traces in it to justify these magnificent postulates of hundreds of thousands of years, which seem to me born of a science closely akin to charlatanry. What then is the key? I am bound to say I know not at present, and I see no harm in saying so. I will also say, however, that that is why, like many others, I am desperately anxious to see anthropology made the subject-matter of closer study by a larger number of serious students, and to see a part of our great Museum devoted to its illustration. Hence these tears, and hence all this impudence.

HENRY H. HOWORTH.

V.

The Structure of the Graptolites.

THE following paper is an attempt to lay before English readers an account of recent additions that have been made, principally by Swedish workers, to our knowledge of graptolite structure. The literature referred to will be found at the end of the article.

Methods of Preparation.

To investigate the internal structure of graptolites, different workers have used somewhat different methods of research according to the nature and completeness of the material.

Törnquist (5 and 11), who had at his disposal pyritised specimens imbedded in slate and preserved in relief, ground a series of sections. For each section he used one specimen, with the advantage that the original of each drawing is preserved. Gümbel, and after him Holm (7 and 16) and myself (13, 14, 18), have worked with chitinous material imbedded in limestone, or, at least, in more or less calcareous rocks. For us, therefore, it was most practical to dissolve the specimens from the matrix by means of acid. For further examination of the cleaned specimens, Holm, as palæontologists so often have to do, has utilised the instructive accidental fractures, and has also made little dissections. He has, besides, drawn successive stages of ground specimens still in the matrix, while he has combined both methods by cleaning out ground specimens by suitable processes.

The following lines give a short account of the method I have used, which is more fully described in my work "Ueber die Graptoliten" (18).

For dissolving I have, according to the nature of the rock, used hydrochloric, acetic, and hydrofluoric acids. From pure compact limestones, from marly and glauconitic or strongly calciferous marl-slates, I have cleaned out graptolites with fairly strong, raw hydrochloric acid. Adhering slaty lamellæ and glauconite granules are afterwards dissolved in hydrofluoric acid. Acetic acid is only used when there is reason to believe that the specimen under examination is more than usually fragile.

For cleaning out graptolites from strongly argillaceous marl-slates one cannot use hydrochloric or hydrofluoric acid at once, but the lime has first to be removed by soaking with acetic acid, whereby the matrix keeps its shape, but naturally becomes of looser

consistence. After having been washed with water the rock may be treated with hydrofluoric acid until the graptolite becomes free.

From siliceous rock I have cleaned out graptolites with hydrofluoric acid, using the most concentrated, fuming acid, at a strength of 55 per cent. Even from clay-slate itself graptolites may be cleaned out with hydrofluoric acid, although for various reasons rarely with good result. Cleaned out graptolites that are not to be further treated ought, after having been carefully washed in water, to be kept in glycerine in glass tubes stopped with corks and made air-tight with gold size, asphalt varnish, copal varnish, or something of the kind.

For examining the internal structure I have followed two different methods. The one, followed chiefly when dealing with Graptoloidea, consists of a kind of bleaching of specimens selected for that pupose. This bleaching I at first brought about by means of Schultze's maceration fluid, a re-agent long used by botanists, consisting of strong or concentrated nitric acid and chlorate of potash in solid shape. Subsequently, however, I have adopted another and milder re-agent, eau de Javelle or potassium-hypochlorite. In spite of the violence of the methods, one can, after some practice, venture upon bleaching even when only one specimen is at disposal. After bleaching, the graptolite should be washed in water and in alcohol of gradually increasing strength. It is now devoid of colour, but not clear. For clarifying, chloroform is best; but often one can just as well use turpentine, toluol, oil of cloves, or other ordinary clearing fluid. Sometimes the graptolite is so colourless that it does not need to be bleached, but may be clarified after simple passing through alcohol.

The other method consists of making series of sections of the cleaned out graptolites. This method I have chiefly used for the Dendroidea, which on the outside have a periderm so thick that the thin inner walls would be consumed long before the outer periderm had time to become transparent. The method for making series of sections is the same as nowadays is used in most zoological laboratories. The interpretation of a series of sections is considerably facilitated by making a plastic reconstruction from it.[1]

The periderm may consist of pyrites or a yellowish brown, brown, or black substance, that has been called chitin, and that probably once consisted of some at all events chitin-like substance originating in a way similar to true chitin. I therefore consider the periderm as the epidermis of the vanished animals.

The Structure of the Graptolites.

I.—GRAPTOLOIDEA.

In describing the structure of the Graptoloidea I shall begin with those that are morphologically simplest, that is, with the Monograptidæ,

[1] See NATURAL SCIENCE, vol. iii., p. 340, November, 1893, and vol. vii., p. 379, December, 1895.

taking *Monograptus dubius*, Suess, as an example (see especially 14). Figs. 1 and 2 represent the sicula end, Fig. 1 from the sicula side, Fig. 2 from the opposite (or anti-sicula) side. The sicula, except as regards the passage to the first theca, is bilaterally symmetrical, and consists of an older, less pointed, and thin-walled initial portion (*s*) prolonged into a hollow rod (virgula, *v*.), and one younger, larger, apertural portion (*s'*), provided with lines of growth and a mouth-spine (*sp*).

The sicula, having reached a certain size, produces, as is shown by the lines of growth in the periderm, a new individual, the first theca (t_1), which lies alongside the sicula and grows in the opposite direction. This first theca again gives rise to another theca (t_2), and so on. The thecæ in the Graptoloidea are all of one kind, but their shape varies in different groups and species, and has been used as the basis for division into genera. The thecæ may be somewhat cylindrical or prismatic in all their length; or sometimes they may be contracted at the mouth like the neck of a bottle, widening again into a broad aperture; or the outer edge of the mouth may be prolonged like a roof above the next theca and so on.[1]

Azygograptus I consider to be a *Didymograptus*-like form, in which the one branch is wanting, so that it has a certain resemblance to *Monograptus*. From this genus, however, it is clearly separated in time, which, perhaps, is of greater consequence in the case of graptolites than in that of any other fossils, since the graptolites have such a limited vertical distribution.

Dimorphograptus, whose sicula-region is constructed like that of *Monograptus*, may be considered as a transition-form between Diplograptidæ and Monograptidæ.

Among representatives of the Leptograptidæ, no one has as yet come across any material fit for the examination of the internal structure.

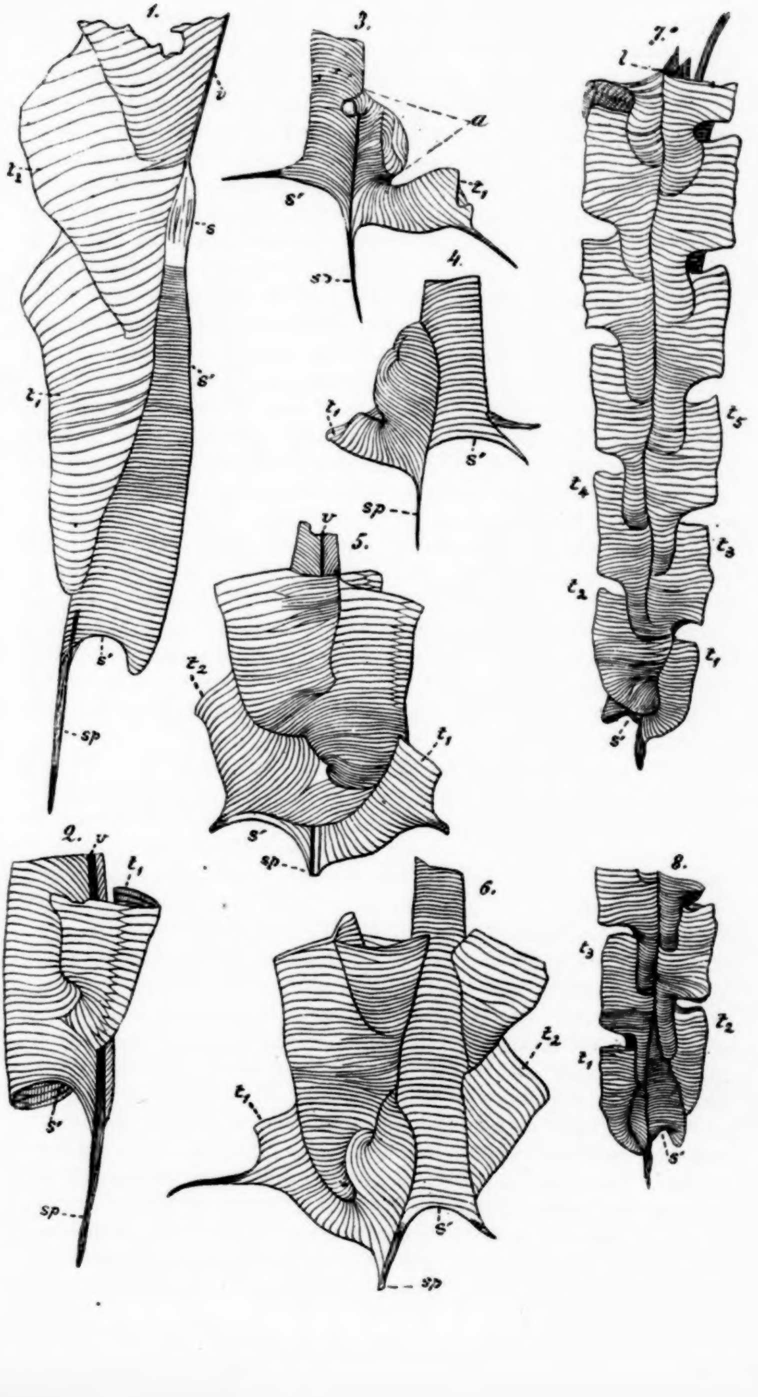
The Diplograptidæ were examined almost simultaneously by Törnquist (11) and myself (13). As regards the actual structure itself we are in accord, but we differ as to the explanation of it and the terminology to be employed. Here I shall first describe the structure of a species of *Diplograptus* and of *Climacograptus kuckersianus*,

[1] *Cf.* Jaekel (8) and Gürich (9).

EARLY STAGES OF GRAPTOLOIDEA.

FIG. 1.—*Monograptus dubius*, sicula end from sicula side. Fig. 2.—The same from anti-sicula side. Fig. 3.—*Diplograptus* sp., sicula end from sicula side. Fig. 4.—The same from anti-sicula side. Fig. 5.—A later stage from sicula side. Fig. 6.—The same from anti-sicula side. Fig. 7.—*Climacograptus kuckersianus*, sicula side. Fig. 8.—Lower portion of same, anti-sicula side. All greatly enlarged.

s, upper part of sicula. s', lower part of sicula; in most cases this is placed opposite the sicula-mouth. *sp*, mouth-spine of sicula. *v*, virgula. t_1, t_2, etc., first, second, and following thecæ. *a*, "connecting canal" of Törnquist, "bud" of Holm. *l*, longitudinal septum.


1.
v
t_1
s
s'
t_1
s'
sp
2.
v
t_1
s'
sp
3.
a
s'
t_1
sp
4.
t_1
s'
sp
5.
v
t_2
t_1
s'
sp
6.
t_2
t_1
s'
sp
7.
l
t_5
t_4
t_3
t_2
t_1
s'
8.
t_3
t_2
t_1
s'

Holm, according to my view, and shall subsequently show how Törnquist differs from me.

Here, too, as appears to be the case with all Graptoloidea, the sicula consists of the two essentially different parts, the initial part, that is prolonged into a virgula, and the aperture-part, with its mouth-spine. In *Diplograptus* sp. (Figs. 3, 4, 5, 6), the sicula-mouth is also provided with two paired lobes, whereas in *Climacograptus kuckersianus* (Figs. 7 and 8) it is more like the sicula in *Monograptus dubius*. In both it is bilaterally symmetrical. From the anti-sicula side of the sicula springs the first theca (Fig. 4), and immediately bends sideways past the mouth-spine over to the sicula side. Here it lies alongside the apertural end of the sicula, which, of course, had the start of it, and the two grow in the same direction. This first theca lies in the plane of symmetry of the sicula, on the same side as the mouth-spine. Such is also the case in *Monograptus dubius*, although the first theca there grows from the beginning in the opposite direction to the apertural end of the sicula (Figs. 1 and 2). To return to the Diplograptidæ: the first theca, having reached as far as the mouth of the sicula, begins to grow in another direction, bending outwards and upwards, towards the distal end of the rhabdome, either much, as in *Climacograptus*, or little, as in *Diplograptus* (Figs. 5 and 6). Before this change in the direction of growth has taken place, and immediately after the first theca has left the sicula, it in its turn gives origin to the second theca, which crosses over and places itself on the opposite side of the sicula (Figs. 3, 5, 6, and 7). This second theca again sends out the third theca, which places itself on the same side as the first.

It has long been known that certain Diplograptidæ are divided by a longitudinal septum. Figs. 7 and 8 show the origin of such a septum. The third theca (t_3) sends out two thecæ: first, one (t_4) towards the side of the second theca, and then one (t_5) towards the side of the first theca. The septum seems to originate in the same way, even when it begins further from the sicula end. When there is a longitudinal septum, the thecæ do not seem to be placed alternately to the same degree as when it is wanting. This is easily understood; for if there is no longitudinal septum, each theca springs from the opposite side of the adjacent proximal theca; where, on the contrary, there is a longitudinal septum, then in those regions of the rhabdome where the septum is, each theca arises from the adjacent proximal theca, and on the same side as it (Fig. 7).

In my opinion, the whole rhabdome thus consists of a colony of animals, in which each individual has budded out from the next eldest. Törnquist, however, contents himself with describing and naming the cavities that are surrounded by the periderm, leaving their nature undecided. The part of the first theca that lies between the passage to the sicula and the passage to the second theca (*a* in Fig. 3) is called by him the "connecting canal." That which was of

old called "the common canal," namely, the set of the inner ends of the thecæ, Törnquist names the "biserial chamber." If, as in *Climacograptus kuckersianus*, a longitudinal septum is present, the "biserial chamber" passes at the beginning of the septum into two "uniserial canals." If, with Törnquist, we regard the peridermal units as representatives of units in a once living colony, then the sicula, the mother-animal of the colony, does not send out one individual but a kind of budding stolon, which passes, in the following order, through the "connecting canal," the "biserial chamber," and, if there is a septum, the "uniserial canals." In the "biserial chamber" this stolon buds alternately to either side; in each of the "uniserial canals" it buds to one side only.

The family Dicranograptidæ is still comparatively little known. On the other hand, the families Dichograptidæ and Phyllograptidæ are better known, and this especially through Holm's examination of *Didymograptus*, *Tetragraptus*, and *Phyllograptus* (16). It appears that the first stages of development of the rhabdome are, in the main, identical in these genera with the stages in Diplograptidæ, wherefore I need not give any further description of the structure of the sicula end in these families. Holm, however, seems not to have decided whether the individuals were formed by budding from a cœnosarc filling the "common canal," or from each other. He, therefore, sometimes speaks of the sicula in *Tetragraptus* and *Phyllograptus* as giving "origin to thecæ, which as in *Didymograptus* and *Diplograptus* are developed from each other, and therefore occupy different heights within the polypary," and sometimes of a "bud" and a "connecting canal." By "bud" Holm means the same structure as Törnquist calls "connecting canal," which I consider as nothing more than that part of the first theca that lies between the passages to the sicula and the second theca respectively (*a* on Fig. 3). By "connecting canal" Holm means something quite different to what Törnquist does, namely, the structure that I regard as the elder part of the second theca.

J. Hopkinson (6) has found specimens of *Tetragraptus serra* and *Didymograptus extensus* in which the common canal is both divided by transverse walls into as many chambers as there are accompanying thecæ, and partitioned off from the thecæ by walls.

Quite recently, at the end of 1895, H. A. Nicholson, and J. E. Marr (19), taking the shape of the thecæ as a marked character, regularly inherited, have arranged a genealogical tree for the family Dichograptidæ, in the same way as in 1895 I derived different groups of *Monograptus*, each by way of its corresponding *Dimorphograptus*, from *Diplograptus* and *Climacograptus* respectively (18).

Fig. 9, taken from Ruedeman (17) shows that colonies of *Diplograptus* were united by their virgulæ into brush-like or almost star-shaped colonies of a higher order, within which there was a division of labour. Beside the *Diplograpti* in the ordinary sense,

easily recognised on the figure, we see a great number of organs of different nature grouped round the central point of union; to these Ruedeman gives the general name of central organs. But his work, which is described as "preliminary," does not give us enough information about these organs. For the present then I would merely remark that *a* in Ruedeman's Fig. 4 can scarcely be regarded as a gonangium, which means an individual or organ for sexual propagation; but that it ought rather to be considered as an individual

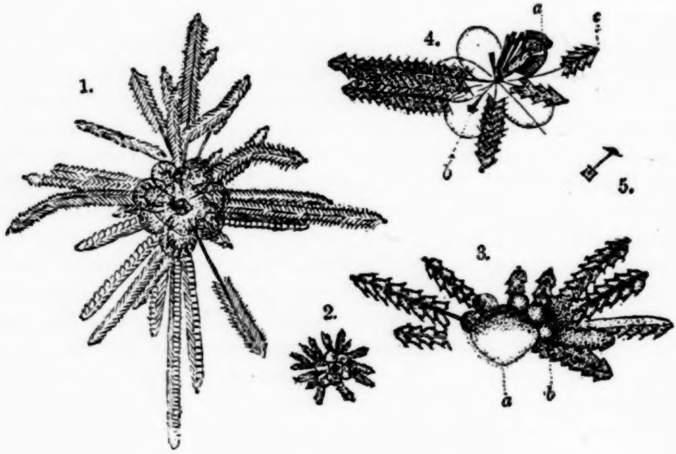


FIG. 9.—COLONIES OF *Diplograptus* (after Ruedemann).

for sexless propagation, a budding individual. It is of interest to get an explanation of the significance of the hollow virgula, so difficult to understand before. Because of this discovery, we cannot but conclude that all graptoloids were, at least temporarily, connected in this way so as to form parts of colonies of a higher order. This discovery may also give us valuable information as to the mode of life of the Graptoloidea.

Upsala. CARL WIMAN.

(*To be continued.*)

VI.

Zoology since Darwin.[1]

WE younger men, whose scientific education begins under the jurisdiction of Darwin, can realise only with difficulty the excitement which his work on the origin of species[2] caused almost forty years ago in the realm of the natural sciences. It fell like a thunderbolt during a period of calm descriptive work, a period which had accustomed itself to regard the natural-philosophy ideas of the beginning of the century as unproved and unprovable sports of fancy, and which, therefore, mistrusting all speculation, clung anxiously to the foundation of fact. What life the selection theory brought into dry description, adding wings to the anatomist's knife, and opening out an extensive horizon before the short-sighted eyes of the systematist! Round the mummies of species, well fenced-in from one another by cleverly-composed Latin diagnoses, the bond of blood-relationship was suddenly drawn. The fossil remains of extinct forms, till then debarred from participation in existence, acquired flesh and blood, and demanded to be classed with the present-day fauna and flora in a single ancestral line representing the story of life on earth.

It is universally known that the idea of a natural genealogical descent of the present animal and vegetable world from the simplest primordial being was suggested long before Darwin's time, and was formulated in detail by Lamarck.[3] But the selection theory of the celebrated Englishman, Darwin, first based the idea upon a scientific foundation. The obvious phenomena of heredity and of variability are the foundations of his bold system, the axles of life's mechanism; and the motive power of this mechanism is the struggle of all living things for the preservation and procreation of life. The origin of the millions of varieties with their different forms, all adapted to special purposes, Darwin has made comprehensible by showing that the preservation of the individual, as well as of the species, entails a continual fight with life-conditions and with competing individuals—a fight in which that only can survive which best corresponds to, and

[1] Lecture delivered by Ludwig von Graff at his formal installation as Rector Magnificus of the K. K. Karl-Franzens University in Graz, November 4, 1895.

[2] "The Origin of Species." By Charles Darwin. Translated by J. V Carus under the title, "Charles Darwin über die Entstehung der Arten." Stuttgart, 1859.

[3] J. Lamarck, "Philosophie zoologique." Paris, 1809. Translated by A. Lang under the title "Zoologische Philosophie von Jean Lamarck." Jena, 1876.

best suits, the prevailing conditions. Thus a natural selection comes to pass: the existing species undergo adaptation, change, separation, and perfection. In the course of the countless great cycles of time, which have flown since the appearance of the first elementary primordial form of life, there arose in this manner the whole series of animal and vegetable organisation, of which man regards himself as the crowning-point. Darwin's teaching quickly became common property, and we trace its influence to-day in almost all spheres of mental activity. His opponents, who, the more they were outside the circle of naturalists, fought not so much against Darwin's own idea, the selection theory, as against the old theory of descent, have continually been growing fewer and quieter, in proportion as Darwinism, from being the standard of a special philosophical idea of life, has become the object of thoughtful scientific research. And the time does not now seem distant when Darwinism will no more be regarded as a party question than is the Copernican astronomical system.

We can then, without prejudice, ask ourselves the question, What influence has Darwin's work had on the development of zoology?

Firstly, it may be noted that at the time of the propounding of Darwin's theories, the two branches of natural history were in very different positions. While in the botanic system physiology had already gained its rightful place, an exclusively systematic morphological adjustment was still reigning in zoology. What wonder that a doctrine, whose main idea was to explain the origin of *forms*, had to bring about a revolution far greater in zoology than in botany? That Darwin himself was above all a zoologist, his examples and evidence being principally taken from the animal world, and that further, the phenomena of the "struggle for life" and of "natural selection" in the animal kingdom are much more obvious and varied than in the vegetable kingdom—these data must be considered if we want to explain why Darwinism took root so much more quickly and deeply in zoology than in botany. Nevertheless, in both it finally prevailed in the same way, and there can be very few examples in the intellectual evolution of mankind that produced such a revolution in the foundations of a science as did the selection theory in the branches mentioned. Description and superficial grouping gave place to the higher problem of the causal foundation of forms; the plodding industry of the describer had to be united with the method of comparison, the eye of imagination.

The first and most important task was the transformation of the system based upon Linnæus and Cuvier into a history of the descent of living forms. E. Haeckel, with his aspiring genius, sought to be fully just to it by sketching the first pedigrees in his ingenious system of the organic sciences—the "General Morphology of the Organism."[1]

[1] E. Haeckel, "Generelle Morphologie der Organismen." Berlin, 1866.

However premature under the then existing conditions of zoology these pedigrees may have been, there is due to them the immortal credit of having given the first impetus to the grand revolution in animal morphology of the last decades. Modern comparative anatomy dates from this period, in which C. Gegenbaur worked side by side with Haeckel. It has since then so completely become the chief part of scientific zoology, that our present text-books are given up almost exclusively to comparative morphology. The biogenetic principle formulated by Haeckel—that ontogeny (evolutionary history of the individual) is a short recapitulation of the phylogeny (history of the stock)—soon overmastered all branches of zoology, pervading comparative anatomy, evolution, and palæontology. Since the forms passed through by the ancesters of any animal are reflected, more o less recognisably, in the temporary varieties of forms during the individual's own development, evolution became the chief doctrine of post-Darwinian time. Its chief result at first was an enormous increase of zoological publications, about 2,900 on an average for one year being published in the period 1845–1860, and about 5,400 per year between 1861–1880.[1] Hand in hand with this increase in literary productions proceeded the improvement in the technique of research. Innumerable methods of staining permitted the growth of the cell to be more exactly studied, the cell-plasma and the nucleus and its elements to be separated according to their different staining capacities.

The tissues of the body, *e.g.*, muscles, nerves, and ligaments, nay, even the different stages of efficacy of the cells of one and the same organ, *e.g.*, the glands, could be separated in microscopic appearance by such new methods of coloration and impregnation. The old "pick and bruise" technique was supplanted by the microtome, whose pricelessness lies in its enabling us to dissect an animal in an uninterrupted series of extremely fine sections. Since by such means we can reconstruct the tissue of an object down to its elemental parts, we are now in a position to examine the inner structure of animals, whose small size had denied all information to the anatomical knife, or whose opaqueness had defied the bruise-method. And, moreover, let us remember the great advance in the serviceableness of the microscope by the construction of the new apochromatic lenses.

All this came as a great help to morphology, and in no earlier period of zoology had so many comprehensive and profound zootomical and embryological monographs been issued. The aim of almost all of these was the proving of the genealogical tree. While, however, the work of comparative anatomy was chiefly to elucidate the relationships of present day forms, evolution strove, in the incompleteness of palæontological results, to elucidate the older stages of animal history by a comparison of ontogenetic forms. One result of this striving is

[1] The authorities for these figures are the "Bibliotheca zoologica," by J. V. Carus and W. Engelmann, Leipzig, 1861, and the "Bibliotheca zoologica," II., by O. Taschenberg, Leipzig, 1887–1896.

the theory of the homology of the germ-membranes. So surely as the egg of all animals has the same value in form as a cell, and directs us to unicellular Protozoa as the starting point of all higher organisms, so surely also must the consequent embryonic phases of the multicellular-tissue creatures (Metazoa) show signs of common ancestry. Haeckel, starting from this premise, thought, in fact, that he could find the image of that ancestral form common to all multicellular organisms in the wide-spread evolutionary stage of the "Gastrula," which consists of two concentric cell-layers and a rudimentary (primitive) mouth.[1] These two cell-layers were determined to be the same (homologous) in all forms, so that here there seemed to be a means of tracing not only within the single lines of descent (phyla), but also through the whole kingdom of the Metazoa, the homology of the organs.

But if we examine without prejudice the facts brought forward, we must admit that this comprehensive attempt has as yet not been successful. The deeper our knowledge of evolution becomes, and the more exactly the comparison is undertaken, the higher also do difficulties tower above us. The essential point, however, is not that it requires a great stretch of imagination to refer all the evolutionary stages mentioned here to the scheme of the Gastrula, nor the circumstance that so often in adult animals organs, similar in form and function, actually originate from different germ-membranes; it is the fact that the primal germ-membranes arise not only in the members of different animal stocks, but occasionally even within one and the same phylum, in such different ways that it would be turning the old idea of homology[2] upside down if one yet regarded them as morphologically equivalent.

And here the hitherto exclusively morphological standpoint alone will hardly be of use. Experimental investigation, while tracing the causes of the various developed species, must first seek to make clear the "inner mechanism of the phenomena of life." Only on these lines can a secure basis be obtained for distinguishing between the "cenogenetic" (secondary falsifications of types) and the "palingenetic" (representing the originally inherited developmental tendency) characters.[3] And until a firmer foundation is worked out for this, a

[1] E. Haeckel, "Die Gastraea-Theorie, die phylogenetische Classification des Thierreichs und die Homologie der Keimblätter." *Jenaische Zeitschrift für Naturwissenschaft*, VIII. Bd. Jena, 1874.

[2] C. Gegenbaur, the Nestor of comparative anatomy, describes as homology (special homology) "the relation between two organs of the same origin, and proceeding from the same stock," and complete homology is present "when the aforesaid organ, even if modified in form, surroundings, and many other respects, has kept itself quite unchanged in position and relationship." (*Grundzüge der vergleichenden Anatomie*, 2 ed. Pp. 80–81. Leipzig, 1870.)

[3] E. Haeckel, "Die Gastrula und die Eifurchung der Thiere" (Chapter "Die Bedeutung der Palingenie und der Cenogenie"). *Jenaische Zeitschr. f. Naturwiss.*, IX. Bd. Jena, 1875.

satisfactory extension of the doctrine of the homology of the germ-membranes, propounded frequently with so much assurance, is not to be thought of.

Doubly valuable, therefore, seemed the morphological facts gleaned from another field of phylogenetic knowledge, namely, the history of fossil forms. Originally an aid to geology, it developed, in the period we are reviewing, into an independent branch of learning, and has borne richer fruit in proportion as it recognised the necessity of going hand in hand with the history of recent forms.[1] Zoology and palæozoology have both the one chief aim, to illustrate the history of animal life on our earth; and a collection answering to modern ideas, which would strive to show an exact picture of present genealogical materials and facts, would have to retain, arranged alongside of recent forms, the fossil remains of extinct species. The service which palæontology has done with regard to synthetic types and transition-forms, as well as to classical evolution-series, is the more important for the completion of the animal pedigree, since the exactness of description permitted by fossils, and the facilities they afford us for verifying their actual relations, lend a certainty and trustworthiness to most palæontological statements not possessed by the morphology of recent forms.

Darwin cautiously left untouched a number of questions not of importance to his selection theory. In fact, it is immaterial to this theory how one may imagine the primary origin of the simplest forms of life, so long as the existence of these forms is proved. In the same way the theories of descent and of selection were unaffected by the circumstance that at the time of their conception one could not picture the concrete foundations of heredity or the primary causes of variability. The existence of these phenomena sufficed as the foundations of the theory. But when, chiefly by German naturalists and philosophers, the amplification of the theory of descent had given rise to a new philosophy of the universe, these weighty questions had to be discussed. Yet, as regards the first of them, the primary creation of the organism, we have progressed no further than a theoretical formulation.

Since there are no chemical elements peculiar to vitality ("life materials"), and since a special "life force" could not be proved, our only alternative was to accept the idea of a "first origin" of the simplest organisms from inorganic elements with the co-operation of the forces active in such inorganic elements. Moreover, since the material

[1] Into this new path palæontology was led chiefly by K. von Zittel. By teaching and research, as well as by the inimitable arrangement of the palæontological collection at Munich, von Zittel has striven to penetrate deep into palæontology and zoology, and his splendid "Grundzüge der Palæontologie" is the result. *Cf.* also von Zittel's "Die Palæontologie und das biogenetische Grundgesetz," in *Aula*, a weekly journal for the academic world, I. Jahrg., p. 385, Munich, 1895 [translated in NATURAL SCIENCE for May, 1895], and also F. v. Wagner's Referat im Biologischen Centralblatt, XV. Bd., p. 840, Leipzig, 1895.

foundation of the life-process, protoplasm, belongs to the group of albuminous carbon combinations, one sought to refer the phenomena upon which life depend to the peculiar chemico-physical characters of carbon. But this so-called carbon theory of Haeckel, like the attempts of O. Bütschli and others, to imitate plasma-structure and plasma-movements by artificial mixing,[1] can as little replace our still defective perception, as can *living* protoplasm follow from a mixture of *dead* albuminous combinations.

An explanation, to some extent satisfactory, of the phenomena that take place at the first beginning of life, is nowadays the less likely to be gained, as chemistry has not yet given us any definite insight into the molecular structure of protoplasm, and as, moreover, from theoretical considerations, there comes the conviction that even the much-quoted "simple protoplasmic mass" is really of very complicated structure, and is not to be so glibly compared to an albumen-mixture.

Moreover, the enthusiasm with which one thought he could recognise in "bathybius" Oken's primary slime as an unindividualised protoplasmic mass covering the bottom of all oceans,[2] has cooled perceptibly. The supposed primary beings without a nucleus shrink also away, since we possess means to prove the existence of the nucleus even in cases where it remains undiscoverable by the primitive research-technique of olden time, and the supposition of a "spontaneous cell development" in organic fluids has given way to the sentence "omnis cellula e cellula." So as soon as it is proved that the last of the monera possess a nucleus like all other cells, there will yawn a much wider abyss between the most simple known forms of life and the inorganic individual, the crystal.

(*To be continued.*)

[1] O. Bütschli, "Untersuchungen über mikroscopische Schäume und das Protoplasma," Leipzig, 1892, as also later papers by the same author in the *Verhandlungen des naturh.-medicinischen Vereins zu Heidelberg.*

[2] The bathybius, as lately shown by Bessels, is probably nothing more than a plasmodium-like organism, whose distribution is locally restricted. *See* "Bronn's Classen und Ordnungen des Thierreichs, Protozoa." Newly revised by O. Bütschli. Pp. 179–181. Leipzig and Heidelberg, 1880.

SOME NEW BOOKS.

Williamson's Reminiscences.

Reminiscences of a Yorkshire Naturalist. By the late William Crawford Williamson, LL.D., F.R.S.; edited by his wife. 8vo. Pp. xii., 228. London: George Redway, 1896.

This is a book that reminds one of the biographies of Edwards and Dick. John Williamson, the father, was the curator of the Scarborough Museum for twenty-seven years, and the boy obtained his first insight into geological studies by assisting his father to name his collection of fossils, on the publication of John Phillips' "Geology of the Yorkshire Coast." Field-work suited young Williamson, and though his long winter evenings were "devoted to the detested labour of naming" "miserable stones," he recognised that this early practical familiarity with fossils moulded the entire course of his future life. After attending three Dames' schools, Williamson went to Pickering to be finished, and was much surprised to find that his first Latin lesson consisted of three lines of the "Æneid," instead of the sixty or seventy lines of Virgil he had been accustomed to. But he found that his new master demanded so thorough a knowledge that the three lines meant far more than the many lines of his earlier days. After a few months spent in France, Williamson returned to London in 1832, and before going home made the acquaintance of Murchison, who took him to the Geological Society and introduced him to Lonsdale; he varied these severer pleasures by a good round of theatres. On reaching Scarborough he found that arrangements had been made for him to enter the medical profession, and he gives a very amusing account of the preparation of the drugs by himself and the senior pupil, their subsequent delivery to the various patients, and the evenings spent with the housekeeper-servant in the kitchen. Other duties of the young medical student of those days consisted of lamp-trimming, sweeping the surgery, bottle-washing, and polishing the counter. The annual accounts seem to have been appalling, and the delivery of them occupied two whole days on horseback. The chief advantage of this early and severe medical training was the amount of open-air exercise it demanded, thus giving opportunities for plenty of collecting, and in the evening his drawings and notes communicated to Lindley and Hutton's "Fossil Flora of Great Britain" were executed at one end of the kitchen table, while the housekeeper prepared the dinner at the other.

Before the termination of his medical apprenticeship, Williamson had been urged to leave Scarborough, but it required considerable pressure from those who had taken an interest in him to induce him to do so. At last he received a letter definitely inviting him to meet the council of the Manchester Natural History Society on a certain day, with a view to his selection as curator of their museum. About September, 1835, therefore, Williamson found himself in Manchester, and though the surroundings were not altogether pleasant by reason

of his being placed over the head of the old curator, he was in the midst of work congenial to him, and he threw himself heartily into it. But the difficulties and troubles of the curatorship ceased in 1840, when, after a three months' stay at Scarborough, he went to London and entered as a student at University College, meeting Lindley, who asked whether he knew W. C. Williamson, of Scarborough, with whom Lindley was perfectly familiar by correspondence. As fellow-students he had Sir William Jenner, Professor Erichson, and Sir A. Garrod. Returning to Manchester after his London work was finished, one of his old boyhood friends came forward with the means necessary to start him in a practice, and in 1841 he mounted his brass plate and started as a doctor. Always an energetic worker, Williamson occupied his leisure by investigating the history of the Diatomaceæ, and the structure of the Foraminifera and of bone. At the same time he commenced those minute studies into the structures of fossil vegetables with which his name will always be associated, the first dealing with the supposed *Zamia gigas* of the Lias of Runswick Bay. A second paper on the same subject was sent to Edward Forbes, and months afterwards, on enquiring about it, he received a penitent letter from Forbes to say that he had put it in so safe a place in his study that he could not find it, and it was subsequently returned to him by Forbes' executors in 1854. The death of John Owens, in 1846, affected Williamson's future career, for in 1851 he was chosen Professor of Natural History to the newly-founded Owens College. The story of his forty years' professorship, and the immense amount of educational and research work done by Williamson is clearly given in this biography, and the old story of the Clayton tree once more attests the enthusiasm of its describer.

From 1887 to the end the story of Williamson's life is briefly and sympathetically told by his widow, his second wife, who refers to his visit to the scenes of his boyhood in 1887, when all his old energy revived, and he was like "an old war-horse roused by the long-forgotten sound of his trumpet." He died in June, 1895, quite worn out. The volume closes with a list of his works, of which the first was published in 1834, and the last in 1895.

AGNOSTIC PALÆONTOLOGY.

ESSAI DE PALÉONTOLOGIE PHILOSOPHIQUE: ouvrage faisant suite aux Enchainements du Monde Animal dans les Temps Géologiques. By Albert Gaudry. 8vo. Pp. 231, woodc. figs. 204. Paris: Masson & Co., 1896. Price 10 fr.

MOST popular expositions of the history of extinct animals are the work of compilers whose knowledge of the subject is merely the result of reading. Those engaged in actual research, as a rule, are too much absorbed in the technicalities of the enquiry, or too little skilled in popular modes of expression, to permit of their catering for the general public. When, therefore, an acknowledged master—an honoured veteran in the ranks of original investigators—undertakes this difficult task, we turn with unusual interest to what we are bound to regard as an authoritative review of the present position of the branch of science in question.

Professor Gaudry's new volume now before us is a work of the latter character. It is a supplement to his well-known three-volumed treatise on "Links of the Animal World during Geological Time," and is intended to be the expression of his matured judgment on the problem of organic evolution. It is a modest essay which will delight the amateur naturalist and the general reader, both by the

charm of its elegant style and by the crowd of unfamiliar facts skilfully marshalled in the argument. From this point of view, we cannot speak of the book in terms of too high praise; we only decline to regard it as a serious contribution to science. There is a singular absence of logic in many of the sections, with too much tendency to bolster up a preconceived idea. There are none but the most inadequate references to the questions raised by the Neo-Lamarkians of North America—questions which are much too serious to be disregarded in any essay which claims to be "philosophical." Professor Gaudry, indeed, admits evolution, and even allows more than we can perceive; but the moment he approaches the possible suggestion of a law, he suddenly stops and pleads ignorance. He naïvely remarks: ". . . on doit avouer que jusqu'à présent on connaît très peu les causes des transformations des êtres. Je ne saurais m'en occuper. La tâche que j'ai entreprise me parait déjà assez difficile."

The main idea of the essay is, that there has been continual progress and a trend towards perfection in the world of life. The known fossils are described as favouring this idea in every way. Organisms in course of time have multiplied more and more on the surface of the earth. They have become more and more differentiated; they have increased in actual size. Each successive period has also witnessed an advance in the activity, sensibility, and intelligence of animals.

Such are the theses, and the various chapters deal with them in the order mentioned.

The idea that organisms are more numerous now than they were in the earliest times, is rather assumed than proved; but it is pointed out that their multiplication would be particularly facilitated in early times by the very general prevalence of a strong armour and the less sedentary character of most of the animals. Professor Gaudry also surmises that the sum of new arrivals exceeded that of the extinctions until the Miocene period, since when there seems to have been some diminution.

The facts concerning the differentiation of organisms form an old story; but the chapter on the size to which animals attain is of great interest and partly novel. Two pages of theoretical restorations, the one of marine and the other of land animals, illustrate the subject; and it is clear that the largest of all known animals are the whales of modern times.

In discussing the progress of activity, Professor Gaudry points out several instances in which the latest forms of a group exhibit more freedom of locomotion than the earlier forms, and remarks that at the present day there are the whales which are the best swimmers, the birds best adapted for flight, the horses best adapted for running, and man best adapted for walking.

There is little of importance to be said concerning the evolution of the senses of sight, hearing, smelling, tasting, and touching. The interesting chapter on the "progress of intelligence," however, affords an opportunity for repeating the now well-worn theme of the increase in size of the brain among mammals as they are traced through the Tertiary period. There are also some observations on the brain of the lower animals, with a very misleading figure of the brain cavity of the Permian Stegocephalian *Actinodon*, the diminutive proportions of which are almost certainly due to the flattening of the skull by crushing.

Finally, Professor Gaudry adverts again to another familiar subject, namely, the application of the results of palæontology to the determination of the relative age of rocks. He points out that

horizons can be recognised not merely by their characteristic fossil species, but also by the general phase of evolution exhibited by each group of organisms in the fauna. This affords the opportunity for another review of the evolution of the fish-tail, the rhinoceros horn, the elephant's tooth, the deer antler, and similar phenomena which Professor Gaudry has so graphically described in his previous works. In fact, the present volume may be treated as a general introduction to his previous volumes, written (as all "introductions" ought to be written) at the close of his labours. We can only conclude by again recommending it to the notice of all who are in want of the essence of palæontology in an extremely pleasant and reliable form.

THE EYESPOT SILKWORM MOTHS.

DIE SATURNIIDEN (NACHTPFAUENAUGEN). Von A. Radcliffe Grote, A.M. Pp 28, pls. 3. Mittheilungen aus dem Roemer-Museum. Nr. 6. Hildesheim, June, 1896.

MUCH attention is now being given to the classification of the Lepidoptera, and a more natural system than that which contented a past generation of entomologists is being slowly marked out. In these studies English-speaking naturalists, on both sides of the Atlantic, are taking a leading part. In this country we have had Dr. Chapman's classical researches on pupal structures, and the careful, systematic work of Mr. Hampson and others; while in America Professor Comstock's discovery of the trichopterous "jugum" in the lowest moth-families, and Mr. Dyar's suggestive classification, founded on the tubercles of caterpillars, have proved of the greatest value. The present work, though German by language and publication, is from the pen of the eminent American lepidopterist, who has already issued, under the same auspices, a valuable study on the Apatelidæ or acronyctid group of owl-moths.

The Saturniidæ include those large silk-producing insects of which the Tussar moth (*Antheræa mylitta*) and the gigantic *Attacus atlas* are familiar examples to all who have examined a collection of Indian Lepidoptera. Abundant in tropical countries, and well-represented in North America, the family has but six European species, of which only one—the "Emperor" (*Saturnia pavonia minor*)—ranges into the British Isles. These insects, with their specialised neuration, reduced mouth-organs, and exceedingly complex antennæ, have considerable claim to be reckoned as the highest of the moth-families. Mr. Grote, however, places them after the hawk-moths (Sphingidæ). He formerly included the families of the common silkworm (Bombycidæ) and the "Kentish glory" (Endromidæ) in the same "super-family" as the saturniids, but recent study of the early larval stages of those insects leads him to consider them more nearly allied to the Eggar-moths (Lasiocampidæ) and their allies, and to place them in the super-family which he now calls "Bombycides," with the vast majority of families of the "Macrolepidoptera." This view of the affinities of the Endromidæ agrees with that held by Messrs. Hampson and Meyrick, but these naturalists would retain the Bombycidæ in the higher place. It may, perhaps, be suggested that the association of families into larger groups must always vary with increased knowledge, and that to lay stress on the definition of "super-families" is apt to obscure the subtle and complex relationships between the families. The saturniids, reckoned as a single family by most lepidopterists, are a super-family, according to Mr Grote, and are divided by him into two families—the Saturniidæ and the Agliidæ. In the former (higher)

section the branches of the median nervure are forked, while in the latter (more primitive) group the lower branch arises from the cell. (It is a pity that writers on moth-neuration do not agree on nomenclature; in the system used by Mr. Grote the numbers of the nervures are reckoned from the costa, while Messrs. Hampson and Meyrick begin to count from the inner margin.) Mr. Grote considers the radial nervure and its branches of the highest structural importance, and points out that the great development of these and the consequent immense spread of the forewings in the Attacina is correlated with a reduction of the body parts and a high complexity in the antennæ. He considers, therefore, the Attacina to be the highest of the saturniids, and supports this view by their method of suspending the cocoon. While the other saturniids fasten their cocoons directly to stems or branches, or spin simply among leaves, the attacines use a leaf which they attach to the branch by an artificial stem of silk. This Mr. Grote believes to be a provision to guard against the falling of the leaf with its contained cocoon to the ground when the natural stem gives way. The wing-expanse of these insects is so great that they cannot rise from the ground, and by this mode of fastening the cocoon it is assured that the moths shall emerge in the upper air.

The value of Mr. Grote's work is materially increased by the very beautiful reproductions of excellent photographs of cocoons and living moths in their natural positions. GEO. H. CARPENTER.

BIRDS, BIRD-SONG, AND BIRDS' EGGS.

A CONCISE HANDBOOK OF BRITISH BIRDS. By H. Kirke Swann. Crown 8vo. Pp. vi., 210. London: John Wheldon & Co., 1896. Price 3s. 6d.

THE EVOLUTION OF BIRD-SONG. By Charles A. Witchell. 8vo, cloth. Pp. x., 253. London: A. & C. Black, 1889. Price 5s.

BRITISH BIRDS, THEIR NESTS AND EGGS. By various well-known authors. Illustrated by F. W. Frohawk. Part I. Ry. 4to. Pp. 48. London: Horace Marshall & Son, 1896. Price 2s. per monthly part.

FOUR COMMON BIRDS OF THE FARM AND GARDEN. By S. D. Judd. THE MEADOW LARK AND BALTIMORE ORIOLE. By F. E. L. Beal. Pp. 405–430 (Yearbook for 1895). U.S. Dept. Agriculture, Washington, 1895.

ALTHOUGH there is nothing to be desired in a handbook of British birds which we do not find in Howard Saunders' well-known "Manual" (not to speak of the works of Seebohm and others), it must be confessed that the question of bulk is sometimes a consideration to travelling naturalists. Saunders' book is a wonderful epitome of facts; but it takes up a whole corner in a portmanteau, and is too bulky to be carried in a man's pocket on a field-day. The same remark applies to most other books. Mr. Swann has sought to supply a tiny text-book, which should contain a description of the plumage of most British birds and their eggs, and which can at the same time be slipped into a corner of a bag, or knapsack, without inconvenience. He has asked too much, perhaps, when he claims that his modest booklet "*has had as yet no rivals*"; for Irby's "Check-list of British Birds" conveys a considerable amount of information, as do some other works of the same kind. Mr. Swann would have been wiser to describe his book as an annotated list of British birds; for this is precisely what it is. He does nominally include the majority of British birds, but *not* all. It is not easy to divine why no mention is made of the collared petrel (*Œstrelata torquata*), figured in the *Ibis*

by Mr. Salvin, as killed on the coast of Wales, when room is given to *Oceanodroma crypytoleucura*, on the strength of a single specimen found dead in Sussex. The omission of the white-faced petrel (*Pelagodroma marina*) is equally inconsistent with the insertion of the capped petrel (*Œstrelata hæsitata*). Generally speaking, no attempt is made to describe the rarer species, though space is wasted on the plumage of the house sparrow, or even on informing us that the land-rail calls at night, as every schoolboy knows. Another drawback to the usefulness of the book is that the descriptions of plumage are nearly always based on adult male specimens, whereas it is immature birds that come most frequently into the hands of the novice. But the book is an honest attempt at assisting the public to become familiar with homely birds, and the author has made a fairly wise choice of the space at his disposal. We trust that a second edition may be called for, in which greater space could be given to explaining the changes of plumage through which most species pass. Mr. Swann may be glad to know that his fears for the extinction of the St. Kilda wren are not likely to be realised at present. This bird has become rather more numerous of late, presumably in consequence of the protection afforded to it by Macleod of Macleod, and his excellent St. Kilda factor, Mr. John Mackenzie.

It is always pleasant to find an author honestly in love with his subject. So many books are written to suit the convenience of publishers that one feels a certain relief at taking up Mr. Witchell's well-printed volume, which is a book of a very different kind. Mr. Witchell is an enthusiastic student of the notes of birds. He is not content to study the notes of adult birds, but starts his investigations with the cries of unfledged nestlings, from which he proceeds to discriminate the various sounds employed by different species to convey their emotions. The author is fortunately of a musical turn, and thus possesses special qualifications for his self-imposed task. A certain portion of the information which he has brought together is drawn from well-known sources, but by far the larger part has been gained at first-hand, and has the merit of being original. Perhaps the most telling chapters of his work are those which discuss the influence of heredity in the perpetuation of the cries of birds, and the influence of imitation in relation to bird-song. Fifteen years have passed since Mr. Witchell first began to study the subject. It is obvious from this circumstance that the theories which he propounds have been long considered, and bear some sign of concentrated thought. It is true that he has only touched the border of the subject, for his observations mainly concern certain species of *Passeres*, which are to be found in Britain.

Perhaps he may have opportunity of extending his observations at some future date. The field of research which he has entered is a wide one. But in the meantime he has succeeded in producing a very agreeable book—just the sort of book to read in a country garden on a summer's day, or in a punt on the Cherwell, for the matter of that. If anyone wants to read a chatty, informal book about wild birds, he should take in hand "The Evolution of Bird-song," for he is sure to be pleased with the writer's cheerful style and happy knack of registering interesting observations.

The rising generation of naturalists are fortunate in the number and quality of the works prepared for their use by the enterprise of publishers. Scarcely a month passes without the announcement of some fresh undertaking, intended to advance the cause of public instruction in the various bypaths of zoology. Especially is this true of British ornithology, which has, no doubt, an ever-increasing

number of votaries. Many of the books on birds which emerge from the popular press appear to be somewhat superfluous. That objection cannot fairly be applied to the work at present under notice. For Mr. Frohawk supplies something that has hitherto been *unprocurable*—a series of beautifully designed plates of British birds, printed from copper plates, and published at a price which brings them well within the reach of the schoolboy and the artisan, neither of whom have much cash to spare for buying birdie books. The first part of this admirable publication furnishes twelve life-size figures, representing the missel thrush, song thrush, redwing, fieldfare, White's thrush, blackbird, ring ouzel, wheatear, whinchat, stonechat, redstart, and black redstart. The birds are depicted in their natural haunts, and the impressions are singularly soft. They form a curious comment on the faulty woodcuts of Yarrell, which have been reproduced in Mr. Howard Saunders' "Manual of British Birds." Mr. Frohawk is one of the most talented of English zoological artists, and the engravers have reproduced his drawings with delicacy and good taste. The plates in black and white are to be accompanied by coloured plates of the eggs of the species included in the work. The first of these plates appears in Part I. The colours are far superior to those of any other cheap series, and many varieties of eggs are shown on the same plate.

The text is well printed, and deals exhaustively with the life-history of the species which have most claim to be included in the British list. Whether Mr. A. G. Butler was the best ornithologist to undertake such an important order as the *Passeres*, must be a matter of opinion. But we have no fault to find with the way in which he has carried out his part so far; only it seems a pity that he gives *no* description of the rarer waifs and strays, such as the desert wheatear. If you tell a man that the desert wheatear has strayed to the shores of Britain, he at once wants to know what the bird looks like. But he will receive no help from Mr. A. G. Butler—not even a reference to Bree's "Birds of Europe," or any other work in which a figure is given. The reason for this withholding of details regarding the very rarest British birds is not apparent. So far as room is concerned, it would have been an easy matter to gain the necessary space by pruning some of Mr. Butler's rather lengthy paragraphs. The neophyte would have then been able to turn to his copy of this work with the certainty that he would find a description of the rare birds which whet his curiosity. Probably, he already knows what a common wheatear looks like, and would gladly have exchanged the plate of that species for one of the bird which is strange to him. But no doubt Mr. Butler has his own reasons for the course which he has adopted. It is satisfactory to know that the staff engaged upon the text of this work includes such competent authorities as Dr. H. O. Forbes, of Liverpool; Mr. W. B. Tegetmeier, F.Z.S., who treats of the game birds; Mr. O. V. Aplin, the Rev. M. A. Mathew, Rev. H. H. Slater, and one or two others. Mr. Frohawk's previous work is a sufficient guarantee that the very high standard of excellence which he has shown in the plates of the first part will be fully maintained throughout the entire work.

To turn to the United States, we are glad to find that the ornithologists there continue to prosecute their useful enquiries into the food of their native birds. On the present occasion Mr. S. D. Judd reports upon the food of the catbird (*Galeoscoptes carolinensis*), the brown thrasher (*Harporhyncus rufus*), the mocking bird (*Mimus polyglottos*), and the house wren (*Troglodytes aëdon*). Figures are given of the species

referred to. The number of mocking birds examined amounted only to fifteen, so that it is unsafe to generalise upon the information gleaned from the contents of their stomachs. Mr. Judd tells us that a strong prejudice exists against this famous mimic on account of the injury which it is alleged to inflict on fruit. It is a bird which attaches itself to human society. "During the period of incubation the song of the mocker is at its best, and is heard at night from the male perched on the gable. Despite this token of its confidence in man, a planter in Florida killed over a thousand mockers and buried them under his grape-vines, because they had taken some fruit"! Mr. Judd admits that in Southern Texas the mocking bird is numerous enough to do some damage to peaches and grapes. "To prevent its ravages it is a common practice to tie up the vines in mosquito netting." On the other hand, the mocking bird is known to destroy many insects. Dr. Stiles states that even in Texas it feeds on large spiders and grasshoppers, while the late Professor Riley enumerated this species among the enemies of the destructive cotton worm. It would seem, therefore, to be entitled to a fair measure of consideration and forbearance at the hands of agriculturists. The catbird and brown thrasher receive much fuller treatment at the hands of Mr. Judd than is accorded to the more interesting mocking bird. It is unfortunate that the European house sparrow should be found to drive the house wren from its nesting-places.

A table is annexed to this paper, from which we learn the different percentages of food constituents found in the stomachs of no fewer than 213 catbirds and 121 specimens of the more retiring brown thrasher.

Mr. Beal deals at considerable length with the food of the meadow lark, three-fourths of which consists of insects, even in the winter time. Complaints have been received from farmers that the meadow lark pulls sprouting corn, and devours newly-sown clover seed. The evidence obtained by the examination of the stomachs of 238 meadow larks completely refutes the charge. The specimens which supplied material for laboratory investigations were collected in twenty-four States, in the district of Columbia, and in Canada, and represent every month in the year. It is only right, however, to observe that of the total insect food of the 238 birds examined, grasshoppers, locusts, and crickets constitute by far the most important element, averaging 29 per cent. of all food consumed during the year. "Even in January they form more than 1 per cent., and increase rapidly until August, when they reach the surprising amount of 69 per cent." The Baltimore oriole, although a general favourite owing to its bright plumage and agreeable vocal powers, has to meet the objection that it levies blackmail on grapes and other fruit, as well as on garden peas. The report on the stomachs of no fewer than 113 individuals, shot between April and August, entirely disproves the notion that this bird is an enemy of the gardener. Mr. W. F. Webster does not appear to overstate the case when he observes that this bird "is worth its weight in gold as an insect destroyer." H. A. M.

SERIAL AND OTHER PUBLICATIONS.

THE 16th *Annual Report* of the Manchester Microscopical Society shows a satisfactory state of things in that the number of members is 214, and there is a balance in hand of some £23. The volume contains numerous interesting papers, of which we may especially notice "Animal Life of the Lancashire Coal Measures," by Herbert Bolton,

illustrated by three half-tone plates from photographs of specimens. A thoroughly practical article on photo-micrography, by E. Hartley Turner, should be useful to others than the members of this society. The presidential address by Professor F. E. Weiss, deals with the influence of external conditions on reproductive processes in plants, showing how the method of reproduction may often be changed by a very slight alteration of surrounding physical conditions. Mr. A. Chopin, in notes on a recent visit to Cumbrae, quotes an interesting account by Captain Turbyne of his attempts on artificially fertilising echinoderms. He fertilised, about the middle of May, the ova of *Echinus esculentus* with the spermatozoa of *Asterias rubens*, and *vice versâ*. It is not stated what degree of development they attained, but "they lived for twelve days quite healthy till the heat killed them."

The Iowa Geological Survey, instead of waiting till its volume is complete for publication, is now issuing separate memoirs as they are ready. We have received "Geology of Woodbury Co.," by H. F. Bain, from vol. v., pp. 241 to 300; "Geology of Warren Co.," by J. L. Tilton, from the same volume, pp. 301 to 360; and "Lead and Zinc Deposits of Iowa," by A. G. Leonard, from vol. vi., pp. 1–66. All these were published in 1896, and are fully illustrated by maps, plates, and text-figures.

Mr. Fred Broughton Weeks has issued a Bibliography and Index of North American Geology, Palæontology, Petrology, and Mineralogy, for 1892–1893, forming No. 130 of the *Bulletins* of the United States Geological Survey. This is an extremely useful book, but its usefulness is considerably marred by the delay in publication. It should not be difficult to issue these annual bibliographies six months after the close of the year, and we are afraid that in this case also, as was pointed out in our note of last month, the delay is due to the Government rather than to the author, for the manuscript was handed in in April, 1895. The Palæontology of 1892 has already been published in the 121st *Bulletin*, by C. R. Keyes, although Mr. Weeks has omitted to state the fact in his introduction.

In our March number, p. 209, we referred to Norwich Castle Museum, and to its excellent illustrated guide by Mr. T. Southwell. A larger edition, price 1s. 6d., has lately been published. "The writer's object has been not to confine himself simply to an enumeration of the specimens actually to be seen in the cases, but rather to use them as illustrations of a general review of the orders to which they belong, and to make this intelligible, he has commenced, in each great natural division, by giving very briefly some slight particulars of the leading characteristics of the group and of the principles on which they are classified." This book will, we are sure, far more than fulfil the modest hope of its author, that it "may be useful to those who visit the collections."

Science for July 24 publishes the interesting presidential address on "The Advancement of Medicine by Research," delivered before the Massachusetts Medical Society, by H. P. Bowditch. He points out the inconveniences of the English law, which, while it secures no guarantee for the humane treatment of animals, is a source of serious annoyance to investigators, who have occasionally been debarred from making experiments of the highest importance. After reviewing the history of the anti-vivisection movement, the author gives illustrations of the lower sensibility to pain as we go down the scale of life, and the frequency under operations of reflex actions which do not denote suffering any more than do the flutterings of a decapitated chicken. Finally he touches upon the main question, the valuable results

accruing from experimental research, such as the discovery of the circulation of the blood, with its vast influence on all modern surgery, and the diphtheria anti-toxin. We would recommend this sensible, moderate, and humane paper to all the well-meaning but ignorant class who wish to abolish, not to restrict, vivisection. In the issue for July 10, there is another common sense paper, touching on this topic, entitled "Physiology in the Schools," by S. H. Gage, of Cornell University.

The *Photogram* for August has a very serious note on a communication made by Dr. Baraduc, "a curer by means of animal magnetism" to the Société de Médecine, in which he states that his "vital fluid" is "a very real force," and deflects magnometers placed near his hands. "If dry plates (in darkness) be used instead of magnometers, the one opposite the right hand will be found on development to show cloudy masses, while the left hand causes dots like a shower of raindrops. . . . Carrying the matter a step further, the doctor finds that by firmly concentrating the mind on a definite object, so as to distinctly visualise a picture thereof, the image may be impressed upon a dry plate. He has found it necessary to concentrate his thoughts for periods varying from ten minutes to two hours, and the difficulty (for most folks an impossibility) of clearly visualising a thought, and of concentrating the mind thereon for any length of time, forms the great drawback to the process." We leave our readers to comment upon this. This number also contains some very beautiful reproductions of photograms of Warwickshire scenery, of which "Guy's Mill," by Dr. J. W. Ellis, deservedly gained the first prize.

Through a difficulty connected with the appropriation-grant for the U. S. Department of Agriculture, the publication of the journal, *Climate and Health*, has been stopped.

The Scientific American published a special double number on July 23, its fiftieth birthday.

A new illustrated entomological journal is announced from Neudamm. It is called *Wochenschrift für Entomologie*, and the subscription is three marks per quarter.

Annuaire des Musées scientifiques et archéologiques des Départements and *L'Année biologique*, under the direction of Yves Delage, are announced from Paris.

Literature Received.

The Biological Problem of To-Day, O. Hertwig: Heinemann. Catalogue of Fossil Bryozoa, J. W. Gregory: British Museum. 13th Report Bureau of Ethnology, J. W. Powell: Smithsonian Inst. Physical Geography, Skertchley: Murby.

A New Factor in Evolution, J. M. Baldwin: *Amer. Nat.* New Mexico Coll. Agric. Bull. 19, T. D. A. Cockerell. Ludwig and Modern Physiology, B. Sanderson: Royal Inst. Recherches biologiques, A. Giard: *Bull. Sci. de la France.* Collections of Fishes, O. P. Hay: Field Columbian Museum.

Nature, July 16, 23, 30, August 6, 13. Literary Digest, July 11, 18, 25, August 1, 8. Revue Scientifique, July 18, 25, August 1, 8, 15. Irish Naturalist, August. Feuille des jeunes Naturalistes, August. L'Anthropologie, VII., No. 3. Naturen, July–August. Amer. Journ. Science, August, Naturæ Novitates, July, 13 & 14. Amer. Naturalist, August. Victorian Naturalist, May. Science. July 10, 17, 24, 31, August 7. Scott. Geogr. Mag., August. Science Gossip, July, August. The Naturalist, August. Westminster Review, August. Amer. Geologist, July. Review of Reviews, August. Pop. Science News, August. Knowledge, August. Biology Notes, June–July. The Photogram, August. The Ornithologist, August.

OBITUARY.

THOMAS HICK.

BORN MAY, 1840. DIED AUGUST, 1896.

ONE of our earliest contributors has passed away in the person of Thomas Hick, the palæobotanist, lecturer in botany at Owens College, Manchester. Mr. Hick was born at Leeds in 1840, became B.A. of London University in 1866, and B.Sc. in 1870. He succeeded Marshall Ward as assistant to the late Professor Williamson in 1885, and his time was mainly devoted to vegetable physiology and histology, and to tutorial work. His earlier papers were connected with the structure of seaweeds, and his later with the elucidation of the structures of the fossil plants of the Coal Measures, on which his views were in friendly rivalry to those of Professor Williamson.

We learn from the *Manchester Guardian* that at a meeting held at the Museum, it was decided to establish some permanent memorial of Mr. Hick, and to collect a sum of money with a view to purchasing his collection of microscopic sections of coal plants and depositing them in the Manchester Museum. Any surplus will be devoted to the purchase of a portion of his library, to be given to the Yorkshire Naturalists' Union or to perpetuate his memory in such other manner as may be decided upon by the contributors. A large committee was appointed to carry out these resolutions, consisting of friends and scientific men representing Lancashire, Yorkshire, and other parts of the country. Professor Weiss was elected secretary and convener.

HEINRICH ERNST BEYRICH.

BORN AUGUST 31, 1815. DIED JULY 9, 1896.

IN Berlin Beyrich was born, there he worked, and there he died. His published writings, chiefly on palæontological subjects, were distinguished examples of conscientious works, and his first monograph, on the goniatites of the Rhenish Devonian, published in 1837, remains after the lapse of half a century one of the classics of cephalopod literature. Similar high rank must be assigned by students of echinoderms to his memoir on the Crinoidea of the Muschelkalk, while they regard his paper on the basis of the Crinoidea Brachiata as one the suggestiveness of which has borne good fruit. The trilobites also shared his attention, while his chief work, on the Mollusca of the North German Tertiary formations, remains unfinished.

The value of Beyrich's work was early recognised, and gained for him important official posts. As teacher of geology in his native city,

he introduced to science many well-known geologists and palæontologists now working in Germany. He was also appointed a director of the Geological Survey of Prussia, and the Thuringian States, and became the head of the Museum of Natural History in Berlin. Along with Von Buch, Humboldt, and other famous men of the past, he was one of the founders of the German Geological Society; and these early associations it may have been that made him a *laudator temporis acti*, and that set his face against innovations. His last visit to this country was to the Geological Congress of 1888, he was elected a Foreign Member of the Geological Society of London in 1876, and one of his latest interests was the assistance he gave towards the compilation of the geological map of Europe now in course of publication.

Beyrich's death makes a widow of one well known in Germany as a writer for children, under the name of Clementine Helm.

JOHANN GEORG BORNEMANN.

Born 1831. Died July 5, 1896.

THIS geologist was born at Mühlhausen in 1831. In 1856 he went for a long tour through Italy, Sardinia, and the neighbouring islands, a journey which resulted in a series of papers on the geology of those places, and by which he is best remembered.

He was one of the enthusiastic band of German palæontologists who worked at the Foraminifera between 1850 and 1860, and his papers on these fossils from the Lias of Göttingen, the Septarienthon of Hermsdorf, and the Tertiaries of Magdeburg contain much valuable information. He died at Eisenach, where his son Ludwig Georg, himself a well-known geologist and a distinguished collaborator in his father's work, resides. C. D. S.

We have also to record the deaths of: Otto Lilienthal, who had demonstrated the possibility of *sailing* through the air, at one bound, some 500 metres with his first-constructed apparatus, while with his second machine, with its wing-like terminations moved vertically by means of a small compressed carbonic-acid gas motor, he had succeeded in sustaining and prolonging his *sail* for a longer distance by flapping these "wings"; J. Lloyd, compiler of a work on the flora of western France, on May 10, in Nantes, aged 87; Dr. F. Von Herder, botanist, on June 7, at Grünstadt; Dr. Kanitz, professor of botany in Klausenberg University; on March 26, in Yokohama, the conchologist B. Schmacker, aged 44; on June 10, Count E. Harrach, an enthusiastic zoologist; A. Gobanz, an authority on the geology and mineralogy of Greece, aged 70; on April 17, A. v. Sommerfeld, a lepidopterist, in Brazil, aged 30; and A. Sallé, a zoologist and explorer, especially known for his conchyliological and entomological researches in Central America.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

THE following appointments are announced:—Mr. Vaughan Harley, to be Professor of Pathological Chemistry in University College, London; G. C. Druce, to be Curator of the Fielding Herbarium at Oxford; Dr. O. Burger, to be Professor of Zoology, and Dr. P. A. Pauly, to be Professor of Applied Geology, at Göttingen; Dr. H. Schenck, of Bonn, to be Professor of Botany in Darmstadt; Dr. E. Knoblauch, of Tübingen, to be Assistant in Botany at Giessen University; Dr. Schuberg, to be Extraordinary Professor of Zoology in Heidelberg University; Dr. F. A. Werf, Director of the Experiment Station at Java, to be Professor of Botany in Munich University, in place of Professor Rauwenhoff, retired; K. D. Glinka, Curator of the Mineralogical Department of St. Petersburg University, to be Professor of Geology and Mineralogy in the Agricultural Institute in Nova Alexandria, Poland; Professor A. A. Tichimirov, of Moscow University, to the Chair of Zoology and the Directorship of the Zoological Museum; Walter W. Froggatt, to be Government Entomologist, New South Wales, in place of the late Mr. A. S. Olliff. Dr. J. v. Gerlach, Professor of Anatomy in the University of Erlangen, Dr. Karl Müller, Professor of Anatomy in the Veterinary High School, Berlin, and Dr. Carl Claus, Professor of Zoology in Vienna University, have retired.

A BILL consolidating the educational institutions of London with a view to the establishment of a central university, has been introduced into the House of Lords by the Duke of Devonshire.

A SCIENCE hall, the gift of Dr. E. H. Williams, was formally presented to Vermont University on June 23. This building will cost about £48,000, and will contain, when completed, departments of electrical engineering, metallurgy, biology, chemistry, and physics. A geological museum and library is to be erected at New York University.

THE University Extension Courses at Odessa have been very well attended, considering that this is the first time they have been attempted in Russia. The attendances were as follows in the various branches of science:—anatomy, 350; bacteriology, 340; botany, 150; chemistry, 150; mineralogy, 130; physics, 300; zoology, 280. These courses last about three months, beginning in October and in January, and the charge for each course is only about 6s. per term.

THE National Collection of Plants, formerly in the custody of the U.S. Department of Agriculture, is now housed in the National Museum, Washington, where a staff of the members has been appointed to take charge of it.

WE are glad to see that a movement is afoot to give a public testimonial to Mr. Mark H. Judge, secretary of the Sunday Society, to whose efforts is largely due the recent Sunday opening of museums. The chairman of the testimonial committee is Canon S. A. Barnett, and subscriptions may be sent to Professor Corfield, at 61 Saville Row, London, W.

WE learn from *Nature* that at the opening of the Hawkes' Bay (N.Z.) Philosophical Institute, the Rev. W. Colenso, F.R.S., President, put before the meeting a scheme for the foundation of a museum to take the place of the present museum at Napier. He offered to give towards the realisation of his scheme the sum of £1,000 and a freehold site, and to supplement this with a second donation of £500 as soon as £500 was given by someone else. The total amount required to establish the museum is about £4,000. Referring to the conditions of the gift, Mr. Colenso said: "The museum must be a building which will be open every day of the week and Sunday afternoons too. I find that this is the case in Auckland, where large numbers visit the museum on Sunday afternoons. . . . There is another proviso, and that is, that the building must only be used for the purposes of a museum and library. There must be no concerts, no Liedertafels, no spouting, no mutual admiration societies, no globe-trotters, no tourists, and no parsons. I will not give a penny for persons of that kind. . . . . The museum proposed would be a museum for the east coast, not only for Hawkes' Bay proper."

THE principal part of the palæontological collection of the late Mr. William Pengelly, of Torquay, has been presented by his widow to the British Museum (Natural History) and to the Museum of Practical Geology, Jermyn Street. The fossils were obtained chiefly from the Palæozoic formations of Devon and Cornwall, but also comprise a series of bones and teeth from the Happaway Cavern, near Torquay.

MR. OLDFIELD THOMAS, of the British Museum (Natural History), returned last month from Uruguay and Argentina, whither he had gone to recruit his health. Notwithstanding the wintry weather experienced, he succeeded in bringing back an important small collection of mammals and insects. On August 21, Mr. A. S. Woodward, of the same museum, left for La Plata to examine the collections of fossil Vertebrata from the Pampas and Tertiary formations of Patagonia. South America has proved an attractive field to the British Museum staff of late, for it will be remembered that Mr. E. E. Austen returned only a short time ago from a collecting expedition up the Amazon.

THE collection of fossil fishes in the British Museum (Natural History) has just been enriched by a fine series of plaster casts and a few original examples of the armour-plates of the gigantic placoderms, *Dinichthys*, and its allies, from the Devonian formation of Ohio, U.S.A. These specimens were obtained from Dr. William Clark, of Berea, through the intervention of Professor E. W. Claypole, who has described most of the originals, and exhibited a nearly similar collection at the British Association meeting last year at Ipswich. The formidable jaws of *Titanichthys* and *Gigantichthys*, two feet in length, are especially striking.

IN the Natural History Reading Room at St. George's Free Library, Buckingham Palace Road, an attempt is being made to arrange an elementary series of zoological specimens, simply labelled and described, with a view of preparing the unscientific mind in some degree more to appreciate the exhibits in a public museum. The specimens of mammals, birds, etc., are accompanied by "reading cases," which consist of scrap-books and elementary volumes dealing with groups, these in their turn leading to more advanced text books or reference books for deeper study. The specimens are unduly crowded, but, as the notice card says, this is unavoidable, as the cases are intended for reference only, and to show at one view the principal members of one group. The object of this Natural History Room is to enable those interested to obtain sufficient knowledge of animals to refer them to their proper relationship, and thus to spread a more definite understanding as to the difference between mammals, birds, molluscs, crustaceans, etc. Even in the present day of educational progress, it is astonishing to notice the number of people who persist in calling whales, oysters, and crabs, *fish*, and if the St. George's Free Library can stamp out these absurd errors in their parish they will have done some good. A series of elementary penny hand lists are sold in the museum, as completed.

As announced in our last number, the Museums Association met in Glasgow from July 21 to 24, and was even more successful than we predicted. The presidential address of Mr. Paton gave a history of the Municipal Museums of Glasgow, which, as well as the Hunterian Museum at the University, were visited during the meeting. H. Coates and A. M. Rodger described the arrangement of the Perthshire Natural History Museum. E. M. Holmes, of the Pharmaceutical Society's Museum, dwelt on the difficulties of discovering type-specimens in many Botanical Museums. Dr. G. Bell Todd's paper on "Colour Tinting and its application to Microscopic Work" had no connection with museum technique. H. Bolton exhibited labels that he had drawn up for the Salford Museum (see NATURAL SCIENCE, vol. viii., p. 140), in order to explain the geological systems, and some discussion took place as to the possibility of issuing sets of labels suitable for more than one museum. F. A. Bather satirically enquired how museums might best retard the advance of science, suggesting many answers from the experience of most of us. In a second paper he advocated the use of electrotypes in Natural History Museums, and exhibited electrotypes of various fossils, which had been prepared by Messrs. Dellagana, of 106 Shoe Lane, E.C., and which met with general approval. G. W. Ord struck rather a new vein in explaining how chemical science and industry might be explained by museum methods; he was treated as the youthful enthusiast, or the prophet in his own country, but Glasgow might do worse than put Mr. Ord's ideas into concrete form. W. E. Hoyle read a letter, written long ago by Huxley, to the Natural History Society in Manchester, in answer to their enquiries as to the best form for a museum. Dr. Sorby's lantern slides constructed from actual marine animals, some of which had been exposed in the Museum at Sheffield for a year, were exhibited by E. Howarth. J. Rankin reported on the present state of the marine station at Millport. An account, by Clara Nördlinger, of a visit to Miss T. Mestorf, the directress of the Schleswig-Holstein Museum of Antiquities at Kiel, was read by W. E. Hoyle, and gave rise to an interesting discussion as to the employment of women in museums; the experiences of various curators had been as various as *il donne e mobile*. T. White advocated the use in museums of such reflectors for electric light as are employed in the picture galleries of well-known dealers.

THE Berlin Academy of Sciences has made the following grants:—Professor Weierstrass, for the publication of his works, M.2,000; Professor Klein, for apparatus for researches in crystallography, M.118; Dr. Burger, for zoological explorations in the Andes, M.3,000; Professor Fütterer, for geological explorations, M.1,000; Dr. Tornquist, for geological explorations in Vicenza, M.1,500; Professor Wernicke, for a photographic atlas of sections of the brain, M.2,000.

A UNION, whose aim is the thorough geological exploration of the northern portion of German East Africa, has been founded in Berlin under the title, "Irangi Gesellschaft." An expedition under its auspices, headed by Lieutenant Werther, and accompanied by two geologists, starts for that locality shortly, and will remain there some fifteen months.

THE citizens of Munich have collected M.71,200 for the Academy of Sciences in that city, to be devoted to the promotion of research.

THE last part of the *Proceedings* of the Bath Natural History and Antiquarian Field Club (vol. viii., no. 3), just received, contains the forty-first annual "Summary" for the session 1895-96, and shows the club to be in a remarkably flourishing condition. Natural History, however, occupies a very small part of its attention, and the extent to which even its prominent members are versed in the most elementary principles of the subject may be inferred from a question of the president, who is reported to have innocently enquired (p. 266) whether any of the Upper Lias fishes in the Moore Collection belonged to species still existing at the present day! We

are grateful for the brief paper on this collection which the club has obtained from Mr. A. S. Woodward, but it is strange that a centre of culture like Bath should produce so little geological and biological work.

In the Report of the Easter excursion of the Geologists' Association to Swanage, Corfe, and Kimmeridge, just published, are some excellent process reproductions of photographs, showing the strata at Tilly Whim, Durlston, and Stair Hole. In the same part of the *Proceedings* will be found the reports of the excursions to Chippenham, Kellaways, and Corsham, including an account of the method of quarrying the Box stone.

The Geological Society of South Africa, which was founded last year for the purpose of preserving the records of the earlier geologists who have written on South Africa, as well as of promoting discussion and investigations on the more recently discovered portions of the colony, has lately come into possession of a most valuable collection of manuscripts and papers, written principally by the late Mr. Andrew Geddes Bain and Mr. G. W. Stow. Among these are the original drawings on a large scale, coloured, of all the sections taken across the country by the late Mr. Stow, and also the numerous papers, including lectures, read before various scientific societies by the father of South African geology, Mr. Andrew Geddes Bain. The society is at present discussing the advisability of erecting a permanent building, to be used as a museum and meeting-room; upon its walls the drawings of Mr. Stow would be exhibited. Mr. David Draper, the secretary of the society, is at present on a short visit to this country.

A presentation, probably in the form of a portrait, is to be made to Professor N. Story Maskelyne by scientific men in England and abroad. Contributions will be received by Professor A. H. Green or Professor H. A. Miers, of the Oxford University Museum.

The statue to Mr. Pasteur, to which we referred in a previous number, is now finished, and is said to be an excellent likeness. It will be erected in the market-place of Alais, where he carried on his researches on the diseases of silkworms.

We are glad to learn that there is every possibility of a permanent museum being founded at the Millport Marine Biological Station, Island of Cumbrae. This is chiefly possible through the generosity of the Marquis of Bute, who has granted a free site of half an acre. As a nucleus of the collections, there will be the valuable material gathered by the veteran naturalist, David Robertson. The station is prepared to supply specimens to laboratories or museums for either dissection or exhibition; a note upon it appeared in our April number, p. 284.

The Municipality of Perth having adopted the Free Libraries Act, it is hoped that the museum of the Perthshire Natural History Society may be taken over by them. This would give the valuable museum, which was described in Natural Science for January, 1896 (vol. viii., pp. 41-45), that stability which cannot be ensured by any private body.

The Minister of Public Works of the Argentine Republic has commissioned Mr. Antonio Gil and Professor José Cilley Vernet to undertake an agronomical investigation into the production of cereals in the province of Buenos Ayres. The investigation will be conducted partly in person and partly by a series of questions addressed to agriculturalists throughout the district, and at its conclusion a detailed report is to be prepared, and presented to the Minister. A full list of the questions to be circulated is given in the *Revista de la Facultad de Agronomia y Veterinaria La Plata*, no. xviii.

Dr. Emil Goeldi continues his practical instructions to collectors in the June number of the *Boletim do Museu Paraense*, contributing also a long biography of Johannes von Natterer, which includes an account of his several voyages, and a portrait. He mentions the great accessions to the collections during the year 1894, especially among the vertebrates and insects. The Geology of Para, by Professor C. F. Hartt, finds a place in the *Boletim*, and Dr. Erich Wasmann prints a paper on the insects commensal with the ants and termites of Brazil.

In the *Daily Chronicle* for Saturday, August 8, there appeared an interesting account of "The Club" which was founded by Dr. Johnson and Sir Joshua Reynolds in 1764. The literary naturalists who have been members of this exclusive body are Oliver Goldsmith (for his "Animated Nature," a translation of Buffon), Sir Joseph Banks, Sir H. C. Englefield, Dean Buckland, Davies Gilbert, Professor Owen, the Duke of Argyll, Sir R. I. Murchison, and Professor Huxley.

Dr. Forsyth Major is expected to reach London before September.

Andrée, after a successful landing on the Dansköar, building of the balloon-house, and filling of his balloon, has been obliged, by a continuous northerly wind, to postpone his ascent, probably till next year. He has however succeeded, we learn, in making a trial trip. The Conway Expedition arrived safely at Hammerfest on August 20. Conway, Gregory, and Garwood succeeded in crossing Spitzbergen. The "Windward," which picked up Nansen, brings favourable news of the Jackson party.

The State College, Centre County, Pennsylvania, is constructing a truncated pyramid of 220 representative building stones, according to the *Engineering and Mining Journal*. This is to be called a geological polylith, and it is intended to be not only an instructive object lesson, but a notice that the Pennsylvania State College is founding a bureau of information concerning the distribution and qualities of building stones. The pyramid will represent in its construction the stratigraphical position of the rocks.

Science gives some statistics obtained from physicians as to the results of antioxin, which on the whole are very favourable, the mortality being decidedly lower than formerly.

Brighton is degnerating. The scheme for altering and extending the Museum, the Library, and the Art Gallery has been shelved indefinitely.

The first reading of the Bill to introduce the use of the metric system into this country took place in the House of Commons on July 30.

The British Association, which meets at Liverpool, on Wednesday, September 16, has arranged for a series of excursions to suit the archæological, geological, zoological, and botanical visitors. The geologists will be led by Boyd-Dawkins and Lamplugh, and will visit the Isle of Man. The zoologists, under the guidance of Herdman and Thompson, will dredge between Port Erin and Ramsey. The botanists, under Weiss and Kermode, will also visit the Isle of Man. A scientific handbook to Liverpool and the neighbourhood is in course of preparation, and the usual facilities will be offered to visitors by the owners of manufacturing and engineering works for an inspection of their buildings. The reception room will be at St. George's Hall.

CORRESPONDENCE.

Sowerby's "Mineral Conchology"—German and French Editions.

I shall be extremely obliged if anyone can inform me of the date of issue of the several parts of the two editions of Sowerby's "Mineral Conchology," published by Louis Agassiz, between about 1839 and 1844. I have tried the usual sources, and, beyond some scattered facts, have obtained little information. Professor Alexander Agassiz, who possesses his father's own copies, tells me that they are bound without the wrappers, and points out the curious indifference of bibliographers as to dates in these early days, as Louis Agassiz himself must have been sensible of the importance of keeping a record.

540 King's Road, London, S.W. — C. Davies Sherborn (*Index gen. et spec. anim.*).

In his notice of my "Ethnology" (Natural Science, August, 1896) the writer charges me with stating that zoologists detach from the class mammals the apes and half-apes, as if these animals were not mammals. This inference would have been avoided had the reviewer quoted the concluding words of the sentence in question: "they [the apes and half-apes] are the chief or most highly specialised members of the class" (p. 17). I may not have "a scientific mind," as he says; but I trust I am not the lunatic I am here made to appear by the *suppressio veri et suggestio falsi* device. It would be well if those who pique themselves on their "scientific mind" paid also a little attention to fair play and accuracy of quotation.

79 Broadhurst Gardens, South Hampstead, N.W. — A. H. Keane.
July 30, 1896.

[The passage in question reads thus: "Zoologists detach from the Class Mammals the large and widespread group of Apes and Half-Apes (Lemurs), which in all modern systems constitute the independent order *Primates*, so named by Linné because viewed as a whole they are the chief or most highly specialised members of the class." We quoted the first sentence as an example of careless writing. We have nothing more to add.—The Reviewer.]

NOTICE.

To Contributors.—*All communications to be addressed to the* Editor *of* Natural Science, *at* 22 St. Andrew Street, Holborn Circus, London, E.C. *Correspondence and notes intended for any particular month should be sent in not later than the* 10*th of the preceding month.*

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